

# THE SYSTEMATICS AND EVOLUTION OF *CIRCAEA* (ONAGRACEAE)<sup>1</sup>

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## ABSTRACT

*Circaea* (Onagraceae) is a well delimited genus and the sole member of the tribe Circaeae. Unlike other Onagraceae, *Circaea* is restricted to the mixed mesophytic and boreal forests of the northern hemisphere and reaches its greatest diversity in eastern Asia, where 12 of the 14 taxa occur. The very closely related *C. lutetiana* subsp. *canadensis* and *quadrisulcata* exhibit the frequent pattern of disjunction between eastern North America and eastern Asia. Hybridization in the genus is common and widespread and has long been recognized in Europe and North America. In Asia, hybridization is equally widespread and more complex because of the greater number of species involved. In all cases, hybrids are highly sterile and, in crosses involving *C. alpina*, they are often completely sterile. Very little or no backcrossing and introgression occur in *Circaea*. Hybrids often form large colonies and reproduce vigorously by vegetative means. They often behave as fertile species in the genus in being wide-ranging, in occupying habitats distinct from those of the parents, in being morphologically similar from population to population and in often occupying ranges partially outside the range of one or both parents. All species are diploid with  $n = 11$ , the original basic chromosome number for the family. The structure of the nectaries, the leaves, and the retention of the basic chromosome number,  $n = 11$ , are generalized characters shared with *Fuchsia*, which is one of the most primitive genera of Onagraceae. *Fuchsia* is bird-pollinated and primarily tropical in distribution while *Circaea*, whose epizoochoric fruits are known from the Oligocene, is pollinated chiefly by syrphid flies and small bees and is temperate in distribution. It is likely that both genera were derived from a common ancestor. The ancestor of *Circaea* apparently reached North America from the probable place of origin for the family in South America. The high diversity of taxa, including the most primitive in the genus, in eastern Asia seems to be related to the favorable climatic conditions prevailing there since *Circaea* reached this region, a well-known center of survival for many Arcto-Tertiary genera, and not to an Asian origin for *Circaea*. The genus has evolved in two directions since its origin: 1) towards more efficient outcrossing through modification of the nectary so that it is more conveniently positioned for visits by short-tongued insects, primarily syrphid flies, and 2) towards self-pollination by having the anthers appressed to the stigma and dehiscing before opening of the buds, and in reduction of the locules in the ovaries and fruits from two to one. *Circaea repens* of the Himalayan region occupies an intermediate position between the two groups in the presence of a trace of a second locule. *Circaea* is treated in accordance with other recent work in the Onagraceae. Seven species are recognized. *Circaea alpina*, the most wide-ranging of the species, comprises six subspecies, each occupying a distinct ecological and/or geographical area. *Circaea lutetiana* includes three subspecies, one each in Asia, Europe, and North America. The remaining species are *C. cordata*, *C. erubescens*, *C. glabrescens*, *C. mollis*, and *C. repens*, all confined to Asia. Three new hybrids, *C. × skvortsovii*, *C. × decipiens*, and *C. × mentiens*, are described, one new combination, *C. × ovata*, is made, and two taxa are changed in status. Full descriptions are provided for the eight known hybrids in addition to those for the species and subspecies.

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## INTRODUCTION

*Circaea* (Onagraceae) is a well-delimited genus and the sole member of the tribe Circaeae. Unlike other Onagraceae, *Circaea* is restricted to the mixed mesophytic and boreal forests of the Northern Hemisphere and reaches its greatest diversity in eastern Asia, where 11 of the 14 taxa occur. The very closely

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related *Circaea lutetiana* subsp. *canadensis* and *quadrisulcata* exhibit the frequent pattern of disjunction between eastern North America and eastern Asia (Fernald, 1915; Hara, 1939, 1952).

Hybridization in the genus is common and widespread and has long been recognized in Europe and in North America (Ascherson & Magnus, 1870; Fernald, 1917; Hara, 1959; Cooperrider, 1962; Raven, 1963; Haber, 1967, 1977), although at times it has led to confusion or incorrect interpretation (Ehrhart, 1789; L veill , 1898, 1900, 1912; Fernald, 1917). Hybridization in Asia is equally widespread and was first suggested by Handel-Mazzetti (1933) and elaborated on by Hara (1936, 1959). I recently reviewed the occurrence of the genus and its hybrids in Japan (Boufford, 1982). In all cases hybrids are highly sterile and, in crosses between the most distantly related species, often completely sterile. Very little or no backcrossing and introgression occur in *Circaea* and hybrids are morphologically intermediate between the parents. Hybrids often form large colonies in naturally disturbed habitats and reproduce vigorously by vegetative means. They often occupy habitats distinct from those of the parents, are wide-ranging and morphologically similar from population to population, and often occur partially outside of the range of one or both parents (Fernald, 1917; Raven, 1963).

*Circaea* differs from most other Onagraceae in containing only flavones (Boufford et al., 1978; John Averett, pers. comm.). All species are diploid, with  $n = 11$ , the original basic chromosome number for Onagraceae, although triploids have been found in *C. × intermedia* (Seavey & Boufford, 1983). Pairing of the chromosomes is usually normal at meiosis, although in some combinations a ring of four chromosomes is formed, indicating the presence of reciprocal translocations differentiating some species (Seavey & Boufford, 1983).

The similarities in the leaves, in the retention of the original basic chromosome number,  $n = 11$ , and in the structure of the nectaries are generalized features retained both by *Circaea* and by *Fuchsia*, one of the more primitive genera of Onagraceae (Eyde & Morgan, 1973). *Fuchsia* is bird-pollinated, primarily tropical in distribution, and has fleshy fruits; whereas *Circaea*, whose epizoochoric fruits, unique in the Onagraceae, are known from the Oligocene (Dorofeev, 1963, 1969; Nikitin, 1957; Szafer, 1947), is pollinated chiefly by syrphid flies and small bees and is primarily temperate in distribution. The floral similarities between *Circaea* and *Lopezia* are only superficial, although both may have had a common ancestor with *Fuchsia*. The differences between *Circaea* and *Lopezia* have been pointed out clearly by Eyde and Morgan (1973).

The ancestor of *Circaea* apparently reached North America in Paleogene time from the probable place of origin for the family in South America. The high diversity of taxa, including the most primitive in the genus, in eastern Asia seems to be related to the favorable climatic conditions prevailing there since *Circaea* reached this region, a well known center of survival for many Arcto-Tertiary genera, rather than to an Asian origin for *Circaea*.

*Circaea* has evolved in two directions since its origin: 1) towards more efficient outcrossing through modification of the nectary so that it is more conveniently positioned for visitation by short-tongued insects, primarily syrphid flies, and 2) towards self-pollination by having the anthers appressed to the stigma and de-

hiscing before opening of the buds and in the reduction of the locules in the ovaries and fruits from two to one. The unilocular *Circaea repens* of the Himalayan region occupies an intermediate position between the two groups in the presence of a trace of a second locule, visible as a darkened line in freehand sections of the fruits, and in appearing to be outcrossing although otherwise resembling *C. alpina*.

*Circaea* is here treated in accordance with other recent work in Onagraceae (e.g., Lewis & Lewis, 1955; Plitmann et al., 1973). My treatment is based on extensive field observations in eastern North America, Japan, central China, and Taiwan, and on living plants in cultivation at Missouri Botanical Garden. Over 25,000 herbarium specimens, from throughout the entire range of the genus, were also examined. Seven species are recognized. *Circaea alpina*, the most wide-ranging species, comprises six subspecies. *Circaea lutetiana* contains three subspecies in as many geographical regions of the world. The remaining species, *C. cordata*, *C. glabrescens*, *C. mollis*, *C. erubescens*, and *C. repens*, are all confined to Asia. Full descriptions are provided for the nine known hybrids in addition to those for the species and subspecies. Three new hybrids, *C. × skvortsovii* (*C. cordata* × *C. lutetiana* subsp. *quadrisulcata*), *C. × mentiens* (*C. alpina* subsp. *alpina* × *C. erubescens*), and *C. × decipiens* (*C. erubescens* × *C. lutetiana* subsp. *quadrisulcata*) are named; three taxa are changed in status.

#### ECOLOGY

Species of *Circaea* grow from warm-temperate, deciduous to cold, boreal forests throughout the northern hemisphere wherever sufficient year-round moisture is available. Although all species, with the possible exception of *C. alpina*, appear to have very broad ecological tolerances, familiarity with the plants in the field shows that each species grows best under fairly specific conditions.

*Circaea mollis* prefers the wettest conditions, often growing in standing or slow-moving water at the edge of streams and in slow seepages in thickets or open forests, usually in loamy soils. *Circaea mollis* is often abundant in *Cryptomeria* plantations along rivers throughout Japan. *Circaea erubescens* grows along cool, clear streams but in coarse sandy soils and where the water is constantly, but not rapidly, moving, and is also common in drier areas such as along forest paths, on roadside banks, and in roadside thickets.

All three subspecies of *Circaea lutetiana* are found most commonly in well drained, deep alluvial loamy soils at the upper part of flood plains or on alluvial slopes and terraces, but very rarely in flood plain depressions.

*Circaea cordata* prefers the most xeric conditions of any *Circaea*, being found on dry, rocky slopes or on raised ground in alluvial forests. *Circaea cordata* may also have a preference for calcareous or other basic soils. It is often found growing near conglomerate rocks or limestone.

The subspecies of *Circaea alpina*, when growing sympatrically, are for the most part separated ecologically, yet several subspecies which are geographically isolated grow in similar habitats. *Circaea alpina* subsp. *alpina*, *micrantha*, and *pacifica* grow along streams or seepages, often on moss-covered rocks and logs

or in wet siliceous soils in conifer forests at medium to high latitudes and altitudes. These three subspecies occupy different geographical areas and only *C. alpina* subsp. *alpina* and *pacifica* overlap in part of their ranges and apparently intergrade completely. *Circaea alpina* subsp. *caulescens* occurs almost totally within the range of subsp. *alpina* but prefers deeper, drier, fine-grained soils in warmer sites in the transitional zone between the mixed deciduous and boreal forests in Japan. Skvortsov (1970a, 1979) reported similar findings for the two subspecies on the Asian mainland. *Circaea alpina* subsp. *imaicola* is geographically isolated from subsp. *caulescens* but grows in similar habitats in the Himalayas, the higher mountains of southern China, and in Taiwan. *Circaea alpina* subsp. *imaicola* also grows at higher elevations in conifer forests, on slopes in seepages, and in thickets. *Circaea alpina* subsp. *imaicola* has been collected as an epiphyte in the Himalayas, and *C. alpina* subsp. *caulescens* grows as an epiphyte near Tomakomai in southern Hokkaido. The few collections of *C. alpina* subsp. *angustifolia* with ecological data indicate that this subspecies prefers warmer sites than *C. alpina* subsp. *imaicola* and grows at lower elevations where the two overlap in range. I saw this subspecies near Kunming, Yunnan, where it occurs in broad-leaved evergreen fagaceous forests. *Circaea alpina* subsp. *angustifolia* grows in fairly deep soils. Subspecies of *C. alpina* with pubescent stems grow in deeper soils in warmer habitats than do subspecies with glabrous stems, which occur in moist, cool habitats, commonly in moss.

In the mountainous regions of western Hubei, China, *Circaea glabrescens* grows in moist to dry, deep soils, usually in openings or at the margins of mixed deciduous forests. The range of *C. glabrescens* on the Chinese mainland is in a region where rainfall averages 750–1,000 mm/year (Hsieh, 1973) and it may be that this species is similar to *C. cordata* in its preference for drier conditions. However, the single collection of *C. glabrescens* from Taiwan is from an area where rainfall exceeds 2,000 mm/year (Hsieh, 1973) suggesting that other factors may also be involved.

The lack of personal observations and scanty label data make it more difficult to determine the ecological preferences of *Circaea repens*. However, *C. repens* appears to prefer deep, moist soils and is often found on slopes and in thickets. Much more detailed studies will be necessary to further clarify ecological relationships of the species of *Circaea*.

#### CYTOLOGY

*Circaea* retains the original basic chromosome number for the Onagraceae,  $n = 11$ . According to Kurabayashi et al. (1962), the mitotic chromosomes of *Circaea* are poorly differentiated into heterochromatic and euchromatic portions and contract more or less evenly at mitosis with the heterochromatic portions remaining visible as chromocenters during interphase. The meiotic chromosomes of *Circaea*, however, are sharply differentiated in this respect and resemble those of the tribes Onagreae and Epilobiae (Seavey and Boufford, in press). This feature may well be correlated with the presence of reciprocal translocations differentiating hybrids and in some cases occurring in natural populations in all three groups.

Seavey and Boufford (in press) review the cytology of *Circaea* and report a gametic chromosome number of  $n = 11$  in all taxa except *C. alpina* subsp. *micrantha*, for which no information is available. In three of the twelve collections of *C. × intermedia* they examined, at least some of the individuals were triploid ( $2n = 3x = 33$ ).

North American diploid collections of *Circaea × intermedia*, as well as one of the five Asian collections examined, were heterozygous for a reciprocal translocation; the others were chromosomally homozygous. Hybrids between *C. cordata* and *C. erubescens*, *C. cordata* and *C. mollis*, and *C. erubescens* and *C. lutetiana* were likewise heterozygous for a single reciprocal translocation, whereas *C. alpina × C. erubescens* was structurally homozygous. The simplest interpretation of these results, although not necessarily the correct one, would be that *C. alpina*, *C. erubescens*, and *C. mollis* have the same chromosome arrangement and differ by one relatively small reciprocal translocation from *C. lutetiana* and *C. cordata* (Seavey & Boufford, in press).

#### REPRODUCTIVE BIOLOGY

The species of *Circaea* can be divided into two groups based on their mode of reproduction. All species with bilocular fruits, and probably also *C. repens*, are predominantly outcrossing but facultatively self-pollinating. *Circaea alpina*, with the possible exceptions of subsp. *caulescens* and some populations of subsp. *angustifolia*, are self-pollinating but facultatively outcrossing. All species of *Circaea*, therefore, are genetically self-compatible.

In species with bilocular, 2-seeded fruits, the flowers open around sunrise and the stigma becomes papillose and receptive a short time after anthesis. The stamens are spreading and held away from the stigma. In most species the stamens are shorter than the style so that automatic self-pollination is impossible. One anther dehisces shortly after anthesis while the other dehisces several hours later, and as late as mid-afternoon. All species, including the unilocular *Circaea alpina*, produce a small droplet of nectar from a ring-shaped nectary that surrounds the base of the style and is exerted from the floral tube in some species. The nectar usually becomes highly concentrated through evaporation by midday, if not removed by insects, and is not evident during the afternoon. At maturity of the flowers the petals are spread widely apart in a 180° plane. The sepals are most often reflexed and, with the petals, form a convenient target for insect visitors (see Kugler, 1938, fig. 3). After a day or two the flowers begin to fade and the petals close toward each other and eventually touch (see Knuth, 1908, fig. 153, and Müller, 1883, fig. 88), the stamens projecting from the openings at the sides and the style extending through the notch at the petal apices. Ultimately the floral tube abscises from the summit of the ovary and the flower falls off. Usually one, and sometimes two, flowers in a given inflorescence open each day, but progression of anthesis is dependent on ambient temperature. I have seen as many as eleven flowers open at one time on a single inflorescence of *C. lutetiana* subsp. *canadensis*, but, on the average, a single inflorescence of that taxon usually bears about five open flowers. Contrary to the report by Haber (1977) that the pedicels of *Circaea lutetiana* subsp. *canadensis* are reflexed at anthesis, they are held

perpendicular to the axis of the raceme as in all bilocular species, and become reflexed only as the flowers begin to fade.

In *Circaea alpina* the anthers regularly dehisce in the bud while appressed to the papillose and receptive stigma. Haber (1967, 1977) and Raven (1963) reported the same findings in plants from Ontario and from the British Isles. Below an ambient temperature of about 15°C or in otherwise unfavorable weather, the buds of *C. alpina* may remain closed with effective pollination taking place. Eventually the buds drop without ever having opened and the ovaries begin to develop. I have noticed that the temperature at which the flowers of *C. alpina* begin to open coincides well with the lowest temperature at which the chief insect visitors to the flowers become active. This adaptation to a means of sexual reproduction independent of the necessity of insects but with retention of the capability for outcrossing under favorable conditions no doubt accounts for the considerable success of *C. alpina* in the cool boreal forests, where it is so widespread. In most subspecies of *C. alpina* the flowers are clustered at the apex of the raceme at anthesis and form a floral unit, in contrast to the individual more or less widely spaced flowers, each functioning as a floral unit in other species of *Circaea*.

The chief visitors to all species of *Circaea* are syrphid flies, with small halictid bees being of somewhat less importance. The mode of visitation varies between different species of syrphids but the way in which the fly eventually alights on the flower is generally the same. When visiting species of *Circaea* with spreading pedicels, syrphids usually approach the base of the raceme first, even though the raceme may be highly elongated and the flowers located near the summit of the raceme. The insect hovers briefly at each maturing ovary while ascending to those which have not yet dropped their flowers. When the fly reaches a fresh flower it hovers briefly in front of the flower and then either flies on to a different raceme or approaches the flowers and eventually alights. Occasionally, syrphid flies will alight on the lowest flowers of a raceme even though these older flowers no longer produce nectar and the anthers have long since shed their pollen.

There is no particular pattern in the manner in which the fly alights on the flower and the insect may grasp any convenient floral part in doing so. Very rarely do the flies approach directly from the front of the flower and grasp the stamens and style in the manner described by Knuth (1908) and Haber (1977). After alighting, the fly maneuvers into various positions while licking nectar from the summit of the floral tube. This constant maneuvering for position while working around the base of the style brings the insect's body in contact with both anthers and stigma. In all species of *Circaea*, several flowers on each raceme are open at the same time and the fly may visit several flowers on the same raceme or fly on to a different plant after visiting only a single flower. When visiting the flowers of *Circaea cordata*, which has closely spaced flowers at the summit of the raceme, syrphids usually walk from flower to flower. On other species with spreading pedicels which are more distantly spaced, syrphids fly from one flower to another.

All subspecies of *Circaea alpina*, with the exception of subspp. *angustifolia* and *caulescens*, have flowers that are borne in dense corymbiform clusters on erect or ascending pedicels and the manner in which syrphids approach these flowers is different from the way they approach flowers on spreading pedicels.

Instead of flying to the base of the raceme, flies approach directly from the top of the cluster of flowers. Flies usually probe each flower for the tiny amount of available nectar and in so doing they come in contact with all open flowers as they walk around the inflorescence from flower to flower.

It is interesting that when syrphids are visiting flowers in a mixed population of plants with both widely spaced and corymbiform flowers, they need from one to three visits to a particular species before they become reoriented to that type of inflorescence. In other words, after visiting several plants with spreading pedicels and approaching from the base or middle of the raceme, a fly will continue to approach from the base or middle of the raceme after switching over to a plant with a corymbiform inflorescence. After visiting one to three consecutive plants with corymbiform inflorescences a fly will then "learn" to approach this type of inflorescence from the top rather than from below.

In mid- to late afternoon some syrphids lick the anthers and stigma in addition to the base of the style or disc, apparently in search of pollen. Halictid bees usually collect only pollen but occasionally appear to be taking nectar also. The insect makes contact with the anthers and stigma in all of the above cases. Differences in the ratios of syrphid flies to halictid bees in different habitats on the flowers of bilocular species of *Circaea* in North America and in Japan agree well with the findings of Kugler (1938) in Europe. Kugler found that in moist habitats *C. lutetiana* subsp. *lutetiana* is visited mostly by syrphid flies while on drier, upland sites halictid bees become more important.

The small halictid bees differ from syrphids in being more deliberate and systematic visitors to *Circaea* flowers and in seeking primarily pollen rather than nectar. Halictid bees also tend to replace syrphids in portions of *Circaea* populations that are in bright sunlight. Bees usually visit all flowers of one inflorescence before moving to a different inflorescence. Instead of hovering in front of each flower before alighting, as do most syrphids, halictids usually fly directly to an open flower and alight, most often grasping some part of the corolla in doing so. The bee then maneuvers for position so that it can grasp a filament with its forelegs, then bends it so that pollen can be easily taken from the anthers. The constant maneuvering brings the bee into frequent contact with the stigma. Occasionally bees were observed licking the portion of the flower near the opening of the floral tube, presumably in search of nectar.

The single most common syrphid on *Circaea* in eastern North America is *Toxomerus geminatus* (Say) with *Melanostoma mellinum* (Linnaeus), *Meliscaeva cinctella* (Zetterstedt), *Rhingia nasica* (Say), and various species of *Sphegina* being of somewhat lesser importance. In Japan, *Episyrphus balteatus* (DeGeer), *Paragus haemorrhous* Meigen, *Sphaerophoria macrogaster* (Thompson) and *Baccha maculata* Walker are the most common syrphids on *Circaea*. Other species of Syrphidae are far less common visitors.

*Dialictus abanaci* (Crawford), *D. atlanticus* Mitchell and *D. leavissimus* (Smith) are the most common Halictidae on the flowers of *Circaea* in eastern North America. The Japanese species of Halictidae were determined by Y. Hirashima of Kyushu University, Japan, and will be reported on in a subsequent paper, along with a more detailed account of pollination in *Circaea*.

All flies collected on *Circaea* are deposited in the collection of the Insect



Identification and Beneficial Insect Introduction Institute, Beltsville, Maryland. The bees are deposited in the collections of the Department of Entomology, University of Kansas, Lawrence, Kansas, and the Department of Entomology, Cornell University, Ithaca, New York.

Other insects such as Lepidoptera, large Hymenoptera (bumblebees), ants, *Drosophila* and other small flies seem to be only casual visitors; they very rarely effect pollination in *Circaea*.

In addition to sexual reproduction, all species of *Circaea* produce underground rhizomes by which they form small to large colonies. This may be the most important means by which the species increase population size in certain habitats. All plants in a population tend to be morphologically very similar even though differences in plants from widely scattered populations are obvious. This is especially true in hybrids, which are nearly or totally sterile and which reproduce by rhizomes even more vigorously than the parents. Despite the fact that species of *Circaea* may occur in colonies of several square meters, it may be that a colony represents only a single genotype with each individual having been derived solely by vegetative reproduction.

#### RELATIONSHIPS OF THE TRIBE

The monogeneric Circaeae are distinct from other tribes of Onagraceae in having 2-merous flowers, the two stamens opposite the sepals, epizoochoric fruits, and in having the viscin threads on the pollen often greatly reduced in number or absent (Skvarla et al., 1978). Unlike other Onagraceae, the center of greatest diversity in *Circaea* is in eastern Asia. Despite these distinct character states, however, attempts to place *Circaea* in a family separate from the Onagraceae (Dulac, 1867; Nieuwland, 1914) are illogical. *Circaea* is more closely related to the line of Onagraceae, containing such genera as *Oenothera*, *Gaura*, *Fuchsia*, and *Epilobium*, than is *Ludwigia*, a genus that has never been questioned as belonging to the family.

*Circaea* exhibits such diagnostic onagraceous features as an *Oenothera*-type embryo sac (Maheshwari, 1950), intraxylary phloem (Metcalf & Chalk, 1950), viscin threads on the pollen (Skvarla et al., 1978), and numerous raphid crystals throughout the plant body. *Circaea* retains the original basic chromosome number for the Onagraceae,  $n = 11$ , and is similar to the monogeneric Fuchsieae and Lopezieae (and *Gongylocarpus* of the Onagreae) in that respect. Eyde and Morgan (1973) have shown that *Circaea* and *Lopezia* are not closely related, leaving Fuchsieae as the tribe with which Circaeae share the greatest number of characters, although the features they have in common are all generalized ones not indicating direct relationship.

#### PHYLOGENETIC RELATIONSHIPS OF THE SPECIES

In determining phylogenetic trends within the genus it is obvious that *Circaea alpina*, which is primarily self-pollinating, has the number of locules reduced to one, lacks viscin threads on the pollen (unique in the family; Skvarla et al., 1978), and produces tubers at the tips of filiform rhizomes, is an advanced species that could not be considered ancestral to any of the other species. Also, since no

other Onagraceae have the nectary projecting beyond the floral tube, it seems unlikely that the primitive *Circaea* should have such a structure. Using these criteria, the primitive species should be outcrossing, have the nectary included wholly within the floral tube, produce bilocular fruits, and have rhizomes without tuberous thickenings. The only two species that fit into this category are *C. cordata* and *C. glabrescens*. The more prominent and sometimes persistent stipules, which are soon caducous in other species, and the occasional 3- or, less often, 4-merous flowers seem to indicate that *C. cordata* is the more primitive of the two. It is, of course, highly unlikely that *C. cordata*, or any other extant species, has given rise to any of the other living members.

From the ancestral species of *Circaea*, an adaptation to pollination by syrphid flies and short-tongued bees provided selection pressures that favored elongation of the nectary so that it is positioned above the opening of the floral tube and is more convenient to insect visitors in the outcrossing species. In the inbreeding *C. alpina*, such selection pressures apparently have not affected the nectary, which remains, as in the primitive species, wholly within the floral tube. This may be correlated with the fact that an insect visitor is able to obtain the minute droplets of nectar from a number of flowers in the crowded inflorescence without expending the energy to fly, as in most Asteraceae. If *C. repens* can be thought of as an intermediate stage along the way to *C. alpina*, the retention of the nectary within the floral tube is understandable.

Figure 1 illustrates the proposed phylogenetic relationships of the species of *Circaea*.

#### HYBRIDIZATION

Interspecific hybridization in *Circaea* is extremely common and widespread and has been the source of much confusion in the genus since 1789 when Ehrhart first described *C. intermedia*. He added the comment that Linnaeus might regard it as a hybrid between *C. alpina* and *C. lutetiana*. Reasons for the confusion have resulted from the fact that hybrids may occur outside of the range of one or both parents, vegetatively they may be more similar to one parent (although analysis of flowers and other critical features reveals their intermediate nature), and they often behave like species in being wide-ranging, growing in habitats more or less distinct from those of the parents, and in occupying a generally well-defined geographical range. Vigorous vegetative reproduction in the hybrids more than makes up for their very low fertility or complete sterility. Raven (1963) clarified the situation in the British Isles where *C. alpina* subsp. *alpina*, *C. lutetiana* subsp. *lutetiana*, and their sterile hybrid, *C. × intermedia*, had often been somewhat confused. The results of Raven's studies are equally applicable to all of Europe, where *C. × intermedia* is common and widespread, and to North America and Asia where different subspecies of *C. lutetiana* are involved in the parentage of similar hybrids. Despite the fact that all three subspecies of *C. lutetiana* hybridize with *C. alpina* subsp. *alpina* to produce *C. × intermedia*, plants of *C. × intermedia* from any of the three geographical areas of the subspecies are usually morphologically indistinguishable from each other. In addition to the studies of Raven (1963) in the British Isles, the studies by Haber (1967,

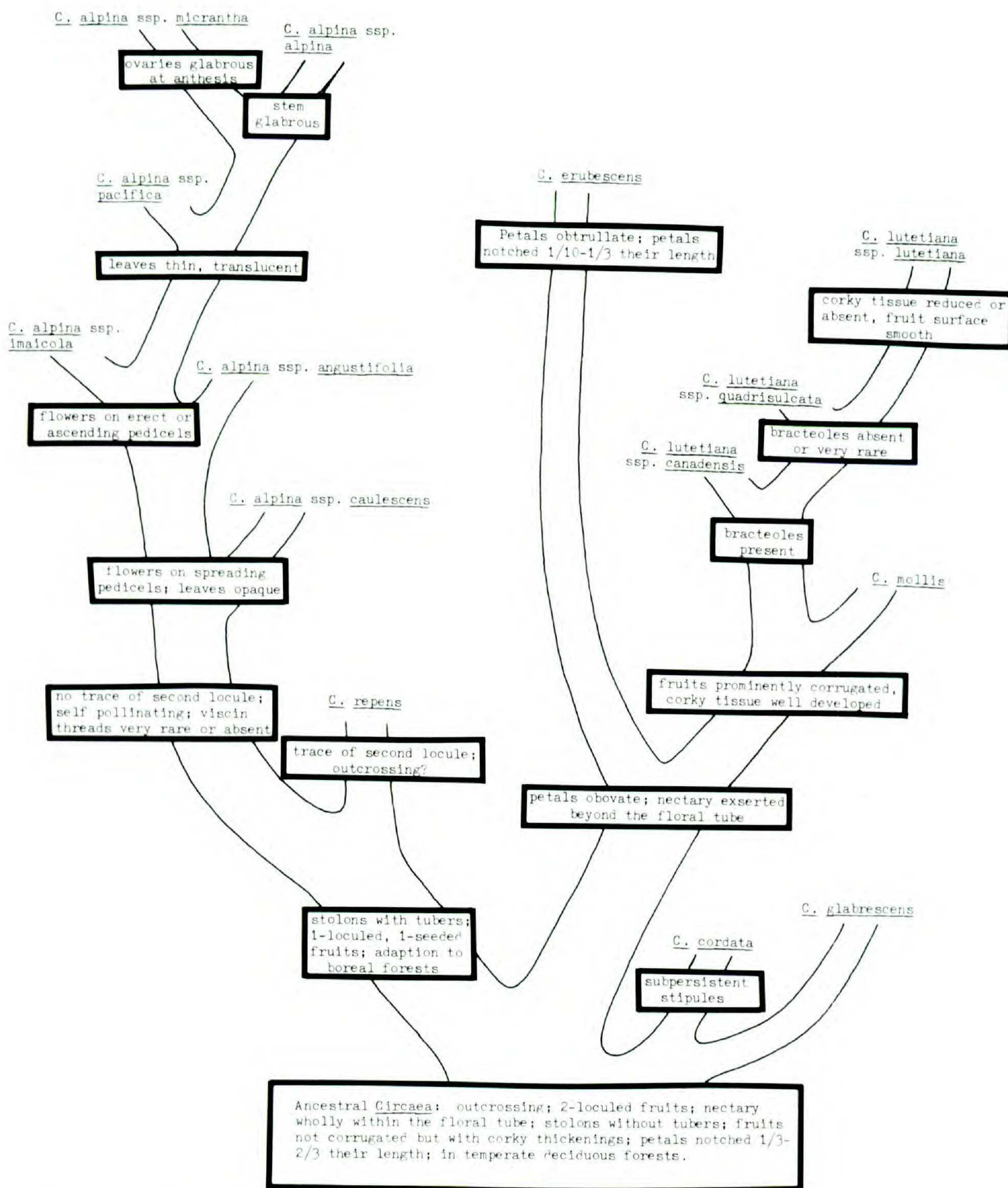


FIGURE 1. Proposed phylogenetic relationships of the species of *Circaea*.

1977) in Ontario and Cooperrider (1962) in Ohio further serve to emphasize the intermediate nature of *C. × intermedia* between the two parental species.

In eastern Asia hybrids are also common but much more complex due to the greater number of parental species involved and have resulted in many misidentifications and wrong interpretations. Handel-Mazzetti (1933) was the first to suggest hybridization between Asian species. He reported a hybrid between *Circaea cordata* and *C. mollis*, which he named *C. × hybrida*, but the type specimen of this entity (Forrest 13254, E) is actually a not uncommon form of *C. cordata* with

rounded to subcordate leaves. Unlike true hybrids of this parentage, the type specimen has highly fertile pollen. Hara's (1934) interpretation of the specimen collected by Nakai, Honda & Kitagawa, 27 August 1933 (TI), on which he based his *C. × kitagawae* as a tentative hybrid between *C. cordata* and *C. lutetiana* subsp. *quadrisulcata* is also *C. cordata*, again with rounded or subcordate leaf bases and with pubescence more sparse than in the majority of plants of *C. cordata*. Again, the type specimen is fertile, with abundant fruit set.

In 1936, Hara named *Circaea × dubia* and correctly interpreted it as being a hybrid between *C. cordata* and *C. erubescens*. This combination is the most frequent hybrid in *Circaea* in Japan and perhaps in all of eastern Asia. Later, Hara (1959), in a more elaborate account of hybridization in *Circaea*, was the first to point out the occurrence of hybrids between *Circaea alpina* subsp. *alpina* and *C. lutetiana* subsp. *quadrisulcata* in Asia. However, the plants that Hara called *C. × dubia* var. *makinoi* (Japan, Mt. Takao, Makino in 1921; MAK; isotypes: S, TI), which he thought were forms of *C. cordata × C. erubescens*, are actually *C. alpina* subsp. *caulescens* and typical of that subspecies.

Plants that Honda (1932) called *Circaea quadrisulcata* var. *ovata* (H. Sekimoto 13; TI) are identical to hybrids of *C. cordata × C. mollis*. The type specimen lacks fruits and its pollen was presumably sterile. Hara (1936) first considered these plants to be a variety of *C. quadrisulcata*; he later (1959) thought that they might be *C. erubescens × C. mollis* but failed to make the appropriate new combination. These plants are here treated as *C. × ovata*. I studied plants identical to *C. × ovata* growing in a *Cryptomeria* plantation with a mixed population of *C. cordata* and *C. mollis* at the northwest base of Mt. Maru-yama in Sapporo, Hokkaido (Boufford & Wood 19855, KYO, MO).

Skvortsov (1977), in an account of *Circaea* for the eastern U.S.S.R., reported *C. × intermedia* (*C. alpina* subsp. *alpina × C. lutetiana* subsp. *quadrisulcata*) from the Far Eastern part of the Soviet Union where it is rare. He showed that plants from the Soviet Far East that had been called *C. erubescens* are, in fact, this hybrid.

Several other hybrids that are apparently less common also occur naturally. These are discussed individually following the treatment of the species in the systematic section. In addition to these, two specimens (Japan, Miyagi Prefecture (Rikuzen), Narugo, Kawatabi, K. Sugawara in 1965 (MO) and China, SW Hebei, Y. Liu 13458 (PE) representing possible hybrids between *Circaea alpina* subsp. *alpina* and *C. cordata* have also been studied. In habit, these plants resemble *C. cordata* but are almost totally glabrous. The nectary is wholly within the floral tube and the lower leaves have rather sharp but low teeth. The leaf bases are rounded rather than cordate in the specimen from Japan, however, and would not be expected in a hybrid of this combination. Insufficient buds are available for pollen analysis to determine fertility. These sites should be revisited in an attempt to obtain more material and to observe the plants in the field in order to determine their parentage. Hybrids between *C. alpina* and *C. cordata* are certainly to be expected. *Circaea alpina* subsp. *alpina* and *C. cordata* grow within a few meters of each other on Rishiri Island in Japan and doubtless also in close contact elsewhere.

Hybrids in *Circaea* are perhaps more common than collections indicate. Some

colonies of hybrids remain totally vegetative or produce only a few, often markedly reduced, inflorescences. These plants are probably passed over by collectors as sterile plants of one of the species. Known hybrids involving *C. alpina* and any of the species with bilocular fruits are especially prone to this behavior, which probably reflects their relatively distant relationship. However, in some hybrid populations (e.g., *C. alpina* subsp. *alpina* × *C. lutetiana* subsp. *canadensis* from Jefferson Co., Pennsylvania, *Boufford 18829*, KYO, MO), flowering is especially prolific. This may be more apparent than real for it may be that unfertilized flowers of *Circaea* remain fresh and persist on an inflorescence for a greater period of time than flowers that are fertilized shortly after opening.

All hybrids in *Circaea* are most common in disturbed areas, and most often in those that are naturally caused. Disturbances caused by man tend to be more drastic and usually result in the destruction of the canopy under which all species of the shade-loving genus *Circaea* grow. Natural disturbances are usually related to flooding along small- to medium-sized streams, which often removes less aggressive herbaceous species from the immediate stream margins. Hybrids are also found away from stream margins in forests where the ground cover has been disturbed. Once hybrids have become established they are often very aggressive, competing favorably with other species and forming colonies of several square meters. Hybrids in *Circaea* reproduce very vigorously by rhizomes and often increase their ranges when pieces of rhizomes break off from the parent plant. Rhizomes are transported, probably most often by water, to other suitable sites. The frequent, extensive populations of morphologically identical plants, which occur along streams for several hundred meters, or even several kilometers as in the case of *C. × dubia* (*C. cordata* × *C. erubescens*, *Boufford & Wood 19798* and *19806*; KYO, MO) along the Okoppe-gawa River in northern Hokkaido, indicate that reproduction by rhizomes may be more common than reintroduction from seeds produced by frequent hybridizations between the parents. The absence of hybrids in mature, undisturbed forests where two or more species grow together as at Mt. Riga, Litchfield County, Connecticut (*C. lutetiana* subsp. *canadensis*, *Boufford & Ahles 18834*; *C. alpina* subsp. *alpina*, *Boufford & Ahles 18833*) and at Shibechea Experimental Forest on Hokkaido (*C. alpina* subsp. *caulescens*, *Boufford & Wood 19761*; *C. erubescens*, *Boufford & Wood 19764*; *C. lutetiana* subsp. *quadrisulcata*, *Boufford & Wood 19765*) further serves to emphasize that disturbance is necessary for the hybrids to become established.

Raven (1963) has given two possible explanations for the occurrence of hybrids outside of the range of one or both parents. One is that the hybrids have been introduced into favorable sites outside of the range of one or both parents by the transport of rhizomes. The other is that hybrids have persisted in sites where they were formed at some time in the past when climatic conditions were favorable for both parental species to grow there together. Also, in Britain, *Circaea* may be spread as a weed in garden soil. Another possibility is that fruits resulting from cross-pollination of one species of *Circaea* by another may be carried by animals, most likely birds, to favorable sites outside of the range of one or both parents. It seems most likely that all of the above processes have played some part in the present-day distribution of the hybrids.

Despite the high incidence of hybridization in *Circaea*, no evidence of back-

crossing or introgression was found either in North America or Japan. Raven (1963), however, indicated that some backcrossing between *C. × intermedia* and *C. lutetiana* subsp. *lutetiana* might take place in the British Isles and that plants referable to *C. lutetiana* var. *cordifolia* Lasch could have resulted from introgression. Weimarck (1973, 1974), using comparative chromatography, but without attempting identification of compounds, suggested possible introgression of *C. alpina* subsp. *alpina* into *C. lutetiana* subsp. *lutetiana* in Sweden. Benoit (1966, 1975) has synthesized *C. × intermedia* by applying pollen from *C. lutetiana* subsp. *lutetiana* to the stigma of *C. alpina* subsp. *alpina*. He (Benoit, 1975) has been able to obtain fruits from backcrosses using *C. × intermedia* as the pistillate parent and *C. lutetiana* subsp. *lutetiana* as the pollen donor, but it is not known if the resulting seeds are viable.

Hybrids of all combinations thus far examined are highly or completely sterile. Crosses involving *Circaea alpina* subsp. *alpina* and species with bilocular fruits are usually totally sterile although occasional plants may have a few filled grains, still rarely exceeding 1% of the total in a given plant. Also, interspecific hybrids involving this species frequently produce many 2-, 4-, and 5-pored pollen in addition to normal 3-pored grains. Percent fertility, based on the number of good pollen grains determined by the method described by Alexander (1969) or with cotton blue in lactophenol, is indicated in the discussion of each of the hybrids.

Hybrids between different species of *Circaea* are most easily recognized in the field by the absence of developing fruits on the elongating raceme axes. Absence of fruits and a high degree of sterility of the pollen are almost always a clear indication of hybridization in *Circaea*. Close examination is needed to determine parentage of hybrids in Asia, especially if one or both parental species are absent from the vicinity of hybrid populations. All hybrids in *Circaea* are usually completely intermediate between the parents morphologically. Hybrids between species having an exerted nectary and those with an included nectary always have the nectary represented by a low, ring-like disc at least partially exerted beyond the opening of the floral tube. Hybrids involving *C. cordata*, which has villous hairs, always have at least a few long hairs on some part of the plant, although the long, straight hairs on the stem of *C. cordata* are usually modified to short falcate hairs on the stems in hybrids. Hybrids between species with darkened nodes and those with green nodes always have the nodes darkened but intermediate in intensity between those of the parents.

Crosses between subspecies of the same species are a completely different matter and would probably be unrecognizable as hybrids. Subspecies of the same species are similar in critical diagnostic features and differ only in pubescence, coloration of the stem, shape and dentition of the leaves, and other more subtle characters. Hybrids between subspecies of the same species would probably be interpreted as belonging to one subspecies or the other. This is especially true within *Circaea alpina*, where subspecies often exhibit morphological intergradation and overlapping ranges. Examples of plants that appear to be intermediate between the various subspecies and which possibly represent intersubspecific hybrids are discussed under the systematic treatment of *C. alpina*.

Further discussions of hybridization are given in the taxonomic treatment.

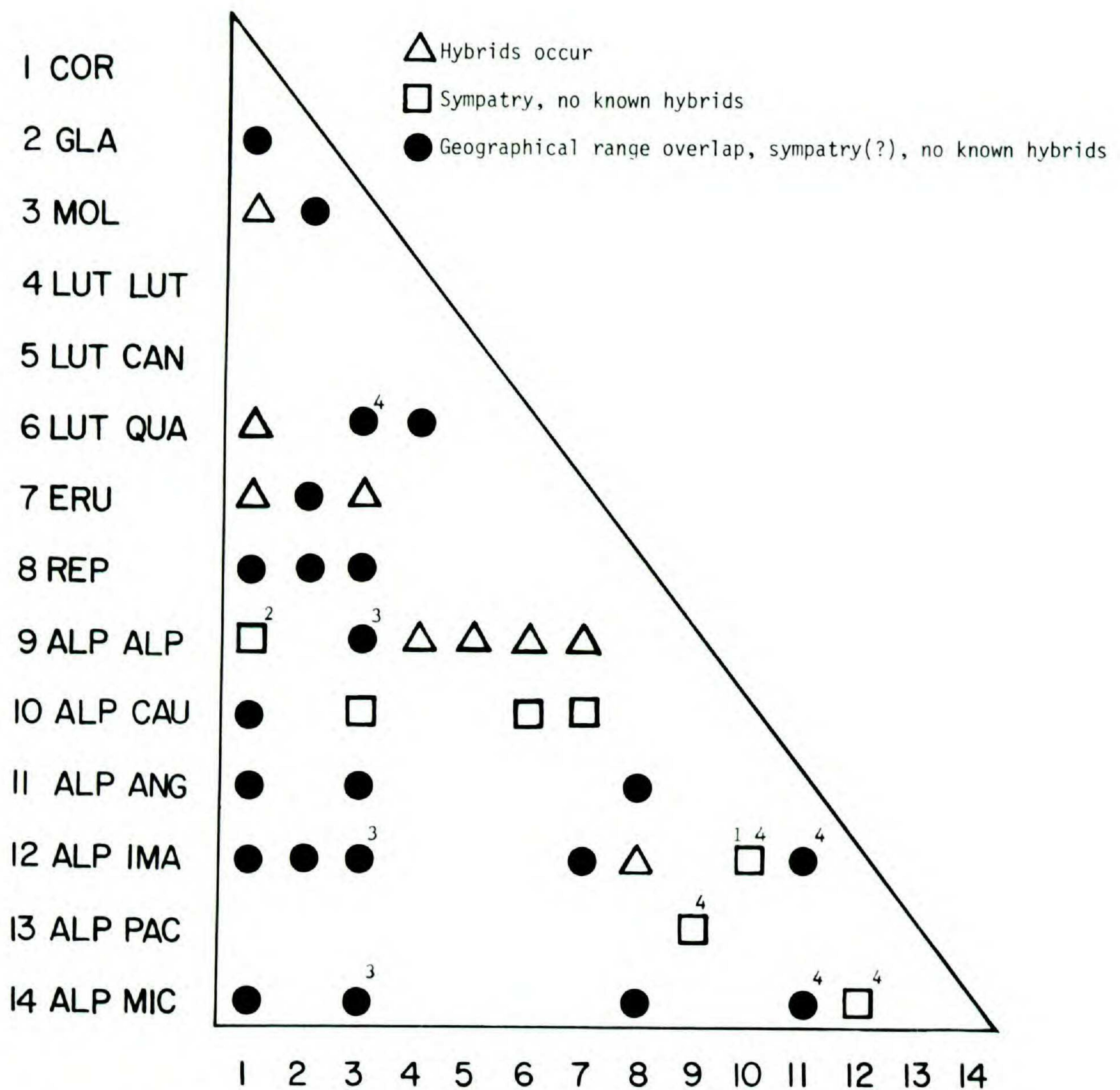


FIGURE 2. Hybridization, sympatry, and geographical range overlap in *Circaea*.—1. *Circaea alpina* subsp. *caulescens* and *imaicola* occur together in China, Anhui Province, on Mt. Huang Shan.—2. *K. Sugawara s.n.* (MO) from Japan, Miyagi Prefecture (Rikuzen Province), Narugo, Kawatabi, and *Y. Liu 13458* (PE) from China, SW Hebei, appear to be hybrids between *Circaea alpina* subsp. *alpina* and *C. cordata*.—3. Probably separated altitudinally.—4. Hybrids which, if they occur, would probably be unrecognizable as such.

Names are provided for hybrids where sufficient material exists to conclusively determine parentage. I have not been able to examine the hybrids between *Circaea alpina* subsp. *imaicola* and *C. repens* nor those between *C. erubescens* and *C. mollis* in the field. The few specimens that exist are insufficient and it therefore seems unwise to apply names to those hybrids at the present time. Further field work is necessary to resolve these two putative hybrids.

Figure 2 illustrates the sympatric occurrence and known instances of hybridization in nature for all taxa of *Circaea*. While it is highly likely that all possible combinations of hybrids can be produced, in several cases the hybrids would probably not be distinguishable from one of the parents, especially in

closely related taxa where pollen fertility might be quite high. Sympatry is here used in a broad sense, meaning only that the ranges of the taxa overlap. Where it is known for certain, either through observations or through mixed collections on herbarium sheets, that the taxa actually grow side by side, this is so indicated.

#### TAXONOMIC HISTORY

The name *Circaea* can be traced back to Dioscorides who originally used it as the name for *Mandragora officinalis* (probably the source of the common names Hexenkraut and Enchanter's Nightshade); it was later transferred to the present genus by Matthioli (Hegi, 1925). Linnaeus (1753), in *Species Plantarum*, provided descriptions for *C. alpina* and *C. lutetiana*, both of which he knew well, and for *C. lutetiana*  $\beta$  *canadensis*, whose description he adopted from Tournefort for the plants from North America. Ehrhart (1789), in naming *C. intermedia*, was the first to suggest hybridization in *Circaea*, even though he considered the plants he was naming to be a species, by adding the comment to his original description that Linnaeus might have considered these plants to be hybrids.

The botanical exploration of India by the British in the early 1800s led to the discovery of the first Asian species: *Circaea repens*, which Wallich (1832) named without describing, and *C. cordata*, which was described and illustrated by Royle in 1834. Despite the fact that European botanists had visited Japan prior to the time of Linnaeus (Ohwi, 1965), it was not until 1843 that the common and widespread *C. mollis* was described by Siebold and Zuccarini and not until 1859 that Maximowicz recognized *C. lutetiana* subsp. *quadrisulcata* as being distinct from the primarily European subsp. *lutetiana*.

Ascherson and Magnus prepared a detailed monograph of *Circaea* in 1870. Their paper showed remarkable insight in spite of the relatively few specimens available to them at the time; in fact, their observations on *C. cordata* were restricted to only the description and illustrations of Royle alone, and for *C. lutetiana* subsp. *canadensis* they saw only seven specimens! They did, however, have *C. mollis* in cultivation and were able to make first-hand observations of the living plants. Ascherson and Magnus were the first to recognize the importance of bracteoles in distinguishing the subspecies of *C. lutetiana*. They also recognized the distinctiveness of *C. alpina* subsp. *imaicola* and provided a description for Wallich's *C. repens*. In 1871 they distinguished and named *C. pacifica* (now *C. alpina* subsp. *pacifica*).

In 1879 Franchet and Savatier named *Circaea erubescens* and in 1910 the last species of *Circaea*, *C. glabrescens*, became known. It was described first as a variety of *C. cordata* by Pampanini.

The various papers by H. Léveillé between 1899 and 1912 added little to the understanding of the genus but did serve to point out the distinctiveness of *C. alpina* subsp. *angustifolia* (*C. lutetiana* race *erubescens* var. *mairi* of H. Léveillé, 1912).

In the twentieth century, with an increase in fieldwork in eastern Asia and the resulting increase in numbers of specimens available for study, most of the work in *Circaea* has led to the recognition of additional infraspecific taxa and an awareness of hybridization in the genus. Komarov (1905) recognized plants from



Manchuria as being distinct from *C. alpina* and called them var. *caulescens*. In 1933, Handel-Mazzetti provided a brief treatment of *Circaea* for China, including a key, brief descriptions of the taxa, and a list of the specimens that were known to him. He did, however, recognize very slender-leaved plants of *C. alpina* from Yunnan as distinct and called them *C. imaicola* var. *angustifolia* (here treated as *C. alpina* subsp. *angustifolia*). Handel-Mazzetti failed to notice that they intergrade completely with H. Léveillé's *C. lutetiana* race *erubescens* var. *mairei*. He also raised *C. cordata* var. *glabrescens* Pampanini to the rank of species, as it has been regarded subsequently. Handel-Mazzetti was the first to suggest hybridization between the Asian species of the genus when he named *C. × hybrida*, although it is now known that the plants on which he based this name are actually *C. cordata*.

Hara, in 1934, published the first of a series of papers dealing with *Circaea*, entitled *Observationes ad Plantas Asiae Orientalis III*, which provided keys and brief discussions for the taxa in Japan, Korea, Taiwan, and Manchuria. This work is important in that it is the first to illustrate clearly the differences in the fruits of several of the Asian species. In a subsequent paper, Hara (1936) described *C. × dubia*, although questioningly, as a possible hybrid between *C. cordata* and *C. erubescens*. Later, he (Hara, 1939, 1952) elaborated on the earlier work of Fernald (1915) concerning the similarity of *Circaea lutetiana* subsp. *canadensis* and *quadrisulcata* in eastern North America and in eastern Asia. These papers served to show that these two subspecies are much more closely related to each other, despite their wide disjunction, than either is to *C. lutetiana* subsp. *lutetiana* in Europe. In 1959 Hara reported on hybridization in the genus on a worldwide scale but with a greater emphasis on *Circaea* in eastern Asia (see above under hybridization).

Recently, Skvortsov (1970a, 1970b, 1977, 1979) has contributed accurate and useful observations on *Circaea* in Soviet Eastern Asia, in the Caucasus Mountains, and in the Himalayas, and has pointed out the distinguishing features of *C. alpina* subsp. *micrantha* from the latter region.

#### MORPHOLOGICAL CHARACTERS

The following characters are those which have been found to be the most useful in distinguishing the taxa of *Circaea* or, where not diagnostically useful, are in need of clarification. General shapes are based on terminology of simple symmetrical plane shapes (Systematics Association Committee for Descriptive Terminology, 1962). Measurements are from dried or spirit preserved material unless otherwise stated. Measurements enclosed by parentheses in the descriptions represent the extremes found in about 5% of the plants of a taxon.

*Habit.* All species of *Circaea* are erect, perennial herbs, although in some species there is a greater tendency for some plants to be decumbent at the base and to produce adventitious roots from the nodes and, less commonly, from the internodes. Decumbent plants are most often found in those species that grow in wet habitats such as *C. erubescens* and *C. mollis* or in those plants that are of hybrid origin. Hybrids involving *C. alpina* tend to be weak and fairly succulent and are especially prone to becoming decumbent.

*Rhizomes.* All species of *Circaea* produce subterranean rhizomes as the overwintering organ. The rhizomes are of two types and can be correlated with other morphological features. Species bearing bilocular fruits produce a number of rhizomes that are long and slender and sometimes branched towards their distal ends. At the end of the growing season the apical meristem of the rhizome becomes dormant and the entire system of rhizomes overwinters, giving rise to a single plant from each apex the following year. The rhizomes in these species never produce tubers at the tips.

In species bearing unilocular fruits the rhizomes are very slender to filiform and less commonly branched. Near the end of the growing season the terminal internodes cease to elongate and the terminal nodes are very closely spaced. This contracted, terminal portion of the rhizome eventually expands radially and forms a small tuber. In *Circaea alpina* the portion of the rhizome between the parent plant and the tuber dies, leaving the tuber as the overwintering organ. Whether or not the proximal portion of the rhizome also dies in *C. repens* is not known. In addition to giving rise to the next year's plants, both types of rhizomes give rise to subsequent rhizomes from their distal nodes during the following year. *C. alpina* and hybrids involving *C. alpina* often produce stolons from the lowermost nodes of the stem. These aboveground stolons are morphologically indistinguishable from the subterranean rhizomes but frequently bear reduced leaves similar to the stem leaves. Eventually these stolons become subterranean at their tips.

Hybrids between bilocular and unilocular plants produce rhizomes that are morphologically intermediate between the two parents in having the terminal portion only slightly contracted, not nearly as thickened as in the tuber-producing parent and in having only a small proximal portion of the stolon dying at the end of the growing season.

A large majority of specimens lack carefully collected underground parts. The very few collections of *Circaea repens* with tubers still attached indicate that tubers in that species may be located a considerable distance below ground level.

*Pubescence.* Pubescence in *Circaea* consists of four basic hair types that vary independently on different parts of the plant. Type of pubescence is often useful alone or in combination with other characters in distinguishing groups of taxa (e.g., subspecies of *Circaea alpina*) and is especially useful in determining hybrid origins. The four basic types are as follows:

I. Long, straight, sharp-pointed, but soft, hairs. Hairs of this type are generally ca. 1 mm long but vary from 0.4 to 1.2 mm long. These are found in nearly all populations of *Circaea cordata*, in some populations of *C. lutetiana* subsp. *lutetiana*, and sporadically in *C. glabrescens*. Long, straight hairs are most abundant on the stems, petioles, leaves, buds, and abaxial surface of the sepals in *C. cordata*. Long hairs on the stem in *C. cordata* may continue into the inflorescence, where they are generally more sparse, or be replaced upwardly by other types of hairs. In hybrids involving *C. cordata* a few long hairs usually occur on some part of the plant but are often unevenly distributed and intermixed with other types of hairs. Long hairs, when present on the buds of hybrids, are a good indication that *C. cordata* is one of the parents.

Plants of *Circaea lutetiana* subsp. *lutetiana*, which were described by Beck (1893) as var. *villosa*, exhibit this type of pubescence on the stem. These plants

occur sporadically throughout the range of *C. lutetiana* subsp. *lutetiana*. Long hairs are absent in *C. lutetiana* subsp. *canadensis* and subsp. *quadrisulcata*.

In *C. glabrescens*, long hairs are occasionally found on the buds.

Besides variation in length, long hairs may be more or less curved above the middle. On dried specimens the hairs become flattened and twisted and appear to be multicellular.

II. Short, soft, falcate hairs ca. 0.2 mm long. This type of trichome is recurved when present on the stem and upwardly curved on the petioles and is found in at least some populations of all taxa. Falcate hairs on the stem are particularly useful in recognizing subspecies of *Circaea alpina* where they are correlated with less easily described characters.

Falcate hairs are usually very dense on the stem in *Circaea mollis* and *C. lutetiana* subsp. *lutetiana* and are found intermixed with long straight hairs on the stem of *C. cordata*. In some populations of *C. erubescens* from Japan and Cheju-do Island, Korea, the falcate hairs are ca. 0.1 mm long and give a dust-covered appearance to the stem under magnification. Plants of *C. erubescens* from the Asian mainland and most populations from elsewhere are glabrous, however. *Circaea alpina* subsp. *pacifica* may have the falcate hairs reduced to only a few, while the usually glabrous-stemmed *C. lutetiana* subsp. *quadrisulcata* may have sparse recurved hairs on the upper part of the stem just below the inflorescence. *C. glabrescens* has sparse to dense falcate hairs on the stem. *C. lutetiana* subsp. *canadensis* and *C. alpina* subsp. *alpina* and most populations of subsp. *micrantha* have the stem glabrous.

III. Capitate and clavate-tipped glandular hairs ca. 0.2 mm long. These hairs are more or less obvious in the inflorescence of nearly all taxa. The hairs are of a single basic type, varying from merely blunt and slightly thickened at the apex to conspicuously capitate. In life they exude a minute but conspicuous, viscid droplet and are especially noticeable in all subspecies of *Circaea lutetiana* and in some populations of *C. mollis*. Glandular hairs are absent in *C. erubescens*, in all populations of *C. alpina* subsp. *caulescens*, and in some populations of *C. alpina* subsp. *angustifolia* and *alpina*.

IV. Stiff unciniate hairs. These hairs are almost totally restricted to the fruit surface and vary in length proportionately to fruit size, ranging from ca. 0.5 to 1.2 mm long. Infrequently they may be found on the upper portion of the pedicel and rarely, in *Circaea cordata*, intermixed with other hairs in the inflorescence. According to Haberlandt (1912) they are unicellular and thick-walled. The unciniate hairs are clear and translucent in all taxa except *C. alpina* subsp. *angustifolia* and a few populations of *C. alpina* subsp. *micrantha*, which have unciniate hairs containing purple pigment. At anthesis the unciniate hairs are soft and short but continue to grow as the fruit develops. In all plants of *C. alpina* subsp. *micrantha* and in a few populations of *C. alpina* subsp. *alpina* and subsp. *imaicola* unciniate hairs are absent from the ovary at anthesis but begin development as the fruit begins to mature after the falling of the floral tube. The hooked hairs easily attach to the fur of animals, to clothing, and to other rough surfaces, no doubt aiding greatly in fruit dispersal.

*Leaves.* Leaf characters are only moderately useful as diagnostic characters in *Circaea*. In most species of the genus the leaves are ovate in shape with

rounded to cordate bases and acuminate apices. They are commonly deep green, thick, and opaque except in the most advanced subspecies of *C. alpina* (subsp. *alpina*, *micrantha*, and *pacifica*), where they are pale green and translucent. Leaf margins range from nearly entire to sharply serrate with the greatest variation occurring within *C. alpina*. *C. alpina* subsp. *angustifolia* has leaves that range from elliptic to trullate to narrowly ovate in shape and with bases that are narrowly to broadly cuneate. *Circaea mollis* also has leaves that are commonly cuneate at the base.

*Inflorescence.* The inflorescence in *Circaea* varies from a simple terminal raceme to a branched panicle of racemes. In addition, simple racemes or branched paniculate racemes are often produced from the tips of the uppermost axillary branches or directly from the uppermost axils. *Circaea cordata* and especially *C. mollis* bear numerous axillary inflorescences. In *C. glabrescens* and less often in *C. cordata* the branches of the terminal inflorescence are oppositely or suboppositely arranged while in other species they are usually alternate. *Circaea erubescens* has the lateral inflorescence branches lax and often unequal in length on a single individual and the inflorescence has a spindly appearance. In other species the inflorescence branches are commonly equal in length, straight and equally ascending.

*Flowers.* The flowers of *Circaea* fall into two major groups based on the presence or absence of an exerted nectary. In the primitive, outcrossing *C. cordata* and *C. glabrescens*, the inbreeding *C. alpina*, and in *C. repens* the nectary is within the floral tube, but completely fills its lower portion. In the remainder of the species the nectary is exerted beyond the opening of the floral tube forming a fleshy disc that completely encloses the style. Nectariferous tissue in these species also completely fills the floral tube. Hybrids between species with included and excluded nectaries always have the nectary present as a low ring at the summit of the floral tube. The nature of the nectary, especially in hybrids, is much more easily determined in living plants. In specimens without flowers but with nearly mature buds the nature of the nectary can be determined under magnification by passing a concentrated beam of light through the unopened bud. The nectary is usually very clearly seen by this method. This was also noticed by Gagnepain (1916).

The petals of *Circaea* are either white or pink and may be either constant or variable in color within a single species. *Circaea cordata* and *C. mollis* have consistently white petals while in *C. erubescens* they are nearly always pink. *Circaea glabrescens*, based on living plants in western Hubei, China, label data, and flower color in dried specimens appears to have consistently pink petals. Coloration of petals in some species, especially in *C. alpina*, may be habitat related with pink petals being produced in open, sunny habitats while white flowers are produced in shaded places. Petal shape is useful in a few species. The obtusate to obovate, very shallowly notched petals of *C. erubescens* and the very deeply notched V-shaped petals of *C. repens* are distinctive, as are the emarginate to very shallowly notched petals of *C. alpina* subsp. *micrantha*.

Style measurements are from the summit of the ovary, including that portion of the style within the floral tube.

*Fruit.* Fruit characters are highly useful in distinguishing major groups and

individual species in *Circaea*. All species have fruits that are more or less densely covered with stiff, uncinata hairs and are well adapted to dispersal by attachment to passing animals. The corky tissue in the fruits of some species, especially in *C. lutetiana* subsp. *canadensis* and *quadrisulcata* and in *C. mollis*, may also be an additional aid to dispersal by water. The report by Christ (1912) that the fruits of *C. alpina* are violently thrown for some distance is erroneous. Fruits of *C. alpina* mature rapidly, however, and are more readily detached by light pressure than those of other species.

*Circaea alpina* and *C. repens* bear unilocular fruits while the remaining species have bilocular fruits. In both cases there is only a single seed in each locule. Freehand sections of the fruits of *C. repens* that I have examined contain a trace of a second locule, represented by a darkened line. There is no trace of an ovule in this remnant locule.

The fruits of *Circaea alpina*, *C. repens*, and *C. lutetiana* subsp. *lutetiana* are clavate in shape, lack corky tissue or have the corky tissue greatly reduced, and have a non-corrugated surface. Fruits of *C. cordata* are flattened orbicular or flattened pyriform in shape and contain longitudinal rows of corky tissue along the margins and between the locules, which show on the surface as low, rounded ridges. Fruits of *C. erubescens* and *C. glabrescens* are more or less ovate to pyriform in shape and, although both contain rows of corky tissue, the surface is smooth except for a shallow groove on the dorsal and ventral surfaces, which represents an extension of the pedicel. *C. lutetiana* subsp. *canadensis* and *quadrisulcata* and *C. mollis* have fruits that are pyriform to globose with prominent, corky thickened ribs and deep sulci. The rare fruits that develop in hybrids are usually intermediate between the two parents but occasionally resemble fruits of one parent more than the other. Fruit measurements are from dried specimens. In most cases this represents shrinkage of 10–15% from live plants. Length and width measurements for the fruits do not include the uncinata hairs.

*Coloration of the stem.* While difficult to use as a diagnostic character to separate species, coloration of the nodes is often useful in determining hybrid origins. *Circaea erubescens* consistently has the nodes reddened and, in life, the stems, and especially the nodes, are succulent and shining. *Circaea mollis* also has the nodes darkened but the usually dense pubescence of minute falcate hairs causes the nodes to appear dull. *Circaea cordata*, on the other hand, has green nodes. In hybrids between either *C. erubescens* or *C. mollis* and *C. cordata* the nodes are darkened but intermediate in intensity between the parents. *Circaea alpina* subsp. *alpina* may have either green or red nodes but hybrids with *C. erubescens* have nodes that are darker than in any *C. alpina* subsp. *alpina*. The coloration of the nodes in other species is less consistent and is an unreliable character.

*Bracteoles.* The presence or absence of a minute bracteole at the base of the pedicel is useful in separating taxa in a few cases but is generally unreliable. *Circaea lutetiana* subsp. *canadensis* may be distinguished from *C. lutetiana* subsp. *quadrisulcata* by the presence of such bracteoles. *Circaea alpina* subsp. *caulescens* is separated from other subspecies of *C. alpina* partly by its nearly constant lack of a bracteole. Several workers, from Ascherson and Magnus (1871) to Munz (1974) have stated that *C. alpina* subsp. *pacifica* lacks bracteoles and have used

this character to separate subsp. *pacifica* from other taxa of the genus, but I have found this to be very unreliable. The majority of specimens of *C. alpina* subsp. *pacifica* have bracteoles subtending at least a few pedicels.

In most species, bracteoles are present at the base of at least the three or four lowest pedicels of a raceme and represent progressively reduced leaves. When determining presence or absence of bracteoles it is best to examine only the middle or upper pedicels.

## SYSTEMATIC TREATMENT

### *Circaea* L.

***Circaea* L., Sp. Pl. 8. 1753.**

*Ocimastrum* Ruprecht, Fl. Ingr. 366. 1860. Nom. illegit., based on *Circaea* L.

*Regmus* Dulac, Fl. Hautes-Pyr. 328. 1867. Nom. illegit., based on *Circaea* L.

*Carlostephania* Bubani, Fl. Pyren. 2: 658. 1910. Nom. illegit., based on *Circaea* L.

Coarse or delicate, usually erect, perennial herbs, producing subterranean rhizomes at the base, these terminated by tubers late in the season in *Circaea alpina* and *C. repens*, which give rise to the following year's plants from the apex; stolons often also present from the lower nodes in *C. alpina*. Plants, except for fruits, totally glabrous (in some plants of *C. alpina* and *C. erubescens*) to densely pubescent with four basic types of trichomes: 1. short, soft, falcate hairs, 0.2–0.3 mm long, which are always recurved on the stems and upwardly curved on the petioles; 2. long, straight or slightly curved sharp-pointed, soft hairs 0.2–1.2 mm long (in *C. cordata* and some plants of *C. lutetiana* subsp. *lutetiana* and *C. glabrescens* and in some hybrids involving *C. cordata*); 3. short, soft, capitate and clavate-tipped, glandular hairs, 0.1–0.3 mm long; 4. stiff, translucent (containing purple pigment in most plants of *C. alpina* subsp. *angustifolia* and some plants of *C. alpina* subsp. *micrantha*), uncinuate hairs, restricted to the fruits or sometimes on the upper portion of the pedicels. Leaves cauline, petiolate, opposite and decussate, horizontally spreading, flat or slightly drooping at the apex; one pair of leaves larger than the others and located from slightly below the middle of the stem to near the base of the inflorescence, the lowest leaves most commonly deciduous by flowering time. Stipules present, caducous or rarely persistent, setaceous or gland-like, green or darkened. Inflorescence terminal on the main stem and often also at the tips of the uppermost, reduced axillary branches or occasionally with the lateral inflorescences arising directly from the uppermost leaf axils. Inflorescence of simple or branched racemes, when branched the lateral racemes arising from near the base of the terminal raceme and subtended by reduced leaves or leaflike bracts. Pedicels erect in bud and clustered at the apex of the raceme, the raceme elongating and the pedicels becoming  $\pm$  distantly spaced, divergent and perpendicular to the raceme axis prior to anthesis or, in most subspecies of *C. alpina*, erect or ascending at anthesis and the raceme elongating after the flowers open; horizontally spreading to strongly reflexed in fruit. Buds valvate, white, green, pink, or purple. Ovary unilocular or bilocular, with one seed per locule. Flowers 2-merous, bilaterally symmetrical, opening in the early morning, the stigma receptive before or shortly after anthesis; one anther

shedding pollen at anthesis, the other with  $\pm$  delayed dehiscence. Floral tube, from a mere constriction at the summit of the ovary, to 2.4 mm long, subcylindric to funnellform, deciduous after maturity of the flower. Sepals two, white, green, pink, or purple abaxially, most commonly white or pink adaxially, spreading or reflexed in flower. Petals two, alternate with the sepals, white or pink, notched at the apex or, in *C. alpina* subsp. *micrantha*, subentire. Stamens two, opposite the sepals, shorter than, to equalling, the style; filaments white or pink, the same color as the petals, very narrowly clavate, attached to the floral tube near its mouth; anthers white, pink or very pale yellow, dorsifixed, longitudinally and introrsely dehiscent. Pollen yellow, shed as monads, 3-pored, rarely with a few 2- or 4-pored grains (in some plants of hybrid origin the pollen may commonly be 2-, 3-, 4-, and 5-pored with 3-pored pollen being somewhat more common), with smooth viscin threads, these often lacking in *C. alpina*. Style white or pink, usually the same color as the petals, filiform, embedded in nectariferous tissue at the base; stigma bilobed, white or pink, usually the same color as the petals, minutely papillate at maturity. Nectary wholly within and filling the lower portion of the floral tube or elongated and projecting above the opening of the floral tube as a fleshy, cylindrical or ring-like disc. Fruit an indehiscent capsule, deciduous with the pedicel at maturity, covered with soft to firm, translucent (containing purple pigment in most plants of *C. alpina* subsp. *angustifolia* and some plants of *C. alpina* subsp. *micrantha*), uncinata hairs; with or without internal, longitudinal rows of corky tissue, when present, these sometimes very conspicuous at maturity of the fruit. Seeds smooth, fusiform or, more commonly, broadly clavoid to slenderly ovoid, adhering  $\pm$  firmly to the inner ovary wall. Gametic chromosome number,  $n = 11$ .

LECTOTYPE: *Circaea lutetiana* L.; Britton and Brown, Ill. Fl. N. U.S. ed. 2. 2: 610. 1913.

Distribution: Throughout the northern hemisphere in moist, temperate, broad leaved evergreen, deciduous, coniferous, and cool boreal forests. From sea level to 5,000 m elevation, and from 10° to 70° N. Lat.

Ascherson and Magnus (1870) divided *Circaea* into two groups, which they called "divisions," based on the number of locules in the fruit. Included in their *Uniloculares* are *C. alpina* and *C. repens*, with all other species placed in their *Biloculares*. These were later given sectional status by Steinberg (1949) but with the name *Biloculares* of Ascherson and Magnus changed to *lutetiana*. The single line of specialization leading from the bilocular, outcrossing species to the unilocular, self-pollinating *C. alpina*, linked by the intermediate *C. repens*, represents a continuum that makes the formal recognition of these two infrageneric groups unwarranted, especially in a genus of only seven species.

In this treatment, the species and subspecies of *Circaea* are treated in order of their specialization.

Hybrids, because of their widespread and frequent occurrence, are treated here in the same manner as the species and are provided with full descriptions and discussions. The intermediate nature of the hybrids between the parental species and the resulting confusion which they cause make it difficult to write a satisfactory key that will allow easy identification of all taxa. The absence of

quantitative differences between species adds to the difficulty. For those reasons, two separate keys are provided, one for all species excluding hybrids and the other including hybrids. In addition, separate keys are provided for the taxa in Europe and in North America.

Flowers, mature fruits, and carefully collected rhizomes are highly desirable to facilitate identification. The nature of the nectary is most easily determined in living plants.

#### KEY TO THE SPECIES, EXCLUDING HYBRIDS

- 1a. Ovaries and fruits bilocular; rhizomes not terminated by tubers ..... 2
- 2a. Nectary wholly included within the floral tube, not projecting as a cylindrical or ringlike disc above the opening of the floral tube ..... 3
- 3a. Axis of inflorescence pubescent, with falcate, glandular, and long, straight or slightly curved, patent hairs; fruit obliquely thick lenticular to flattened pyriform, obliquely rounded to the pedicel ..... 1. *C. cordata*
- 3b. Axis of inflorescence glabrous or with only glandular hairs; fruit obovoid to pyriform, not at all or only slightly flattened, tapering smoothly to the pedicel ..... 2. *C. glabrescens*
- 2b. Nectary exerted beyond the floral tube, projecting as a cylindrical or ringlike disc above the opening of the floral tube ..... 4
- 4a. Petals obovate to depressed broadly obovate, notched one quarter or more their length; axis of inflorescence and pedicels commonly pubescent ..... 5
- 5a. Fruits with prominently thickened ribs and sulci, broadly obovoid, pyriform, or subglobose, tapering obliquely or rounded to the pedicel; floral tube 0.4–1.2 mm long; plants of North America, eastern Asia and westward between 50° and 60° N. Lat. in the U.S.S.R. to the vicinity of Moscow ..... 6
- 6a. Stem pubescent, often densely so, with falcately recurved hairs; leaves cuneate, rarely rounded at the base; petals 0.7–1.8 mm long; inflorescence subglabrous or pubescent, with glandular and falcately recurved hairs ..... 3. *C. mollis*
- 6b. Stem glabrous or with very sparse, falcately recurved hairs; leaves rounded to subcordate at the base; petals (1.3–)1.9–2.9 mm long; inflorescence densely glandular pubescent, without falcately recurved hairs ..... 4. *C. lutetiana*
- 5b. Fruits without prominently thickened ribs and sulci, broadly clavate to slender obovoid, tapering smoothly to the pedicel; floral tube (0.8–)1.1–2.4 mm long; plants of central and western Europe and south of 50° N. Lat. in southwestern Asia ..... 4. *C. lutetiana*
- 4b. Petals obtrullate, notched one fifth or less their length; axis of inflorescence and pedicels glabrous ..... 5. *C. erubescens*
- 1b. Ovaries and fruits unilocular; rhizomes terminated by tubers ..... 7
- 7a. Petals notched more than one half their length, V-shaped; pedicels glandular pubescent; combined length of mature fruit and pedicel, (6.8–)7.5–15 mm long; leaves with 9–15 secondary veins ..... 6. *C. repens*
- 7b. Petals notched one half or less their length, obovate to obtriangular; pedicels glabrous; combined length of mature fruit and pedicel, 3.5–7.8 mm long; leaves with 4–10 secondary veins ..... 7. *C. alpina*

#### KEY TO SPECIES AND HYBRIDS

- 1a. Ovary bilocular; rhizomes without tuberous thickenings ..... 2
- 2a. Nectary wholly within the floral tube, not present as a cylindrical or ringlike disc projecting above the opening of the floral tube ..... 3
- 3a. Axis of inflorescence pubescent, often densely so, with falcate, glandular and long, straight or slightly curved, patent hairs; fruit obliquely lenticular to flattened pyriform, obliquely rounded to the pedicel ..... *C. cordata*
- 3b. Axis of inflorescence glabrous or with only sparse, glandular hairs, fruit obovoid to pyriform, not at all or only slightly flattened, tapering smoothly to the pedicel ..... *C. glabrescens*



- 2b. Nectary exerted beyond the opening of the floral tube, projecting as a cylindrical or ringlike disc above the opening of the floral tube ..... 4
- 4a. Petals obovate to depressed broadly obovate, notched one quarter or more their length; axis of inflorescence with at least a few glandular or falcate hairs ..... 5
- 5a. Stem with darkened nodes, the nodes purple or brown ..... 6
- 6a. Stem glabrous below the inflorescence ..... 7
- 7a. Leaves prominently toothed, sharply dentate to serrate ..... 8
- 8a. Inflorescence and often pedicels glandular pubescent .....  
..... *C. × intermedia*
- 8b. Inflorescence and pedicels glabrous ..... *C. × mentiens*
- 7b. Leaves denticulate, the teeth low and inconspicuous ..... 9
- 9a. Commonly all fruits developing to maturity; fruits with prominent ribs and deep sulci ..... *C. lutetiana*
- 9b. Commonly no fruits developing to maturity; fruit, when present, with only low ribs and very shallow sulci ..... *C. × decipiens*
- 6b. Stem pubescent below the inflorescence ..... 10
- 10a. Sepals purple; petals often pink ..... 11
- 11a. Plants with at least a few, long, straight, or slightly curved, patent hairs on some part of the plant in addition to falcate and glandular hairs; leaves rounded to subcordate at the base .... 12
- 12a. Plants fertile; Europe and southwestern Asia .. *C. lutetiana*
- 12b. Plants highly sterile; eastern Asia .....  
..... *C. × skvortsovii* and *C. × dubia*
- 11b. Plants without long, straight or slightly curved patent hairs, with only short, falcate and glandular hairs; leaves broadly cuneate to subcordate at the base ..... 13
- 13a. Plants fertile ..... *C. lutetiana*
- 13b. Plants highly sterile ..... 14
- 14a. Leaves rounded to subcordate at the base; pollen less than 1% fertile ..... *C. × intermedia*
- 14b. Leaves broadly cuneate to rounded at the base; pollen usually 1–20% fertile .. *C. erubescens* × *C. mollis*
- 10b. Sepals green; petals white ..... 15
- 15a. Leaves cuneate at the base; plants without long, straight or slightly curved, patent hairs, with only falcate and glandular hairs ..... *C. mollis*
- 15b. Leaves rounded at the base; plants with at least a few, long, straight or slightly curved, patent hairs in addition to falcate and glandular hairs ..... *C. × ovata*
- 5b. Stem without darkened nodes, green throughout except sometimes buds, sepals and petals ..... 16
- 16a. Stem glabrous below the inflorescence ..... 17
- 17a. Leaves prominently toothed, dentate to serrate ..... *C. × intermedia*
- 17b. Leaves shallowly toothed, denticulate ..... *C. lutetiana*
- 16b. Stems pubescent below the inflorescence ..... *C. lutetiana*
- 4b. Petals obtrullate, notched one fifth or less their length; axis of inflorescence glabrous .....  
..... *C. erubescens*
- 1b. Ovary unilocular; rhizomes sometimes with terminal tuberous thickenings ..... 18
- 18a. Nectary included within the floral tube ..... 19
- 19a. Pedicels pubescent with glandular hairs ..... 20
- 20a. Pedicels spreading at anthesis, the flowers loosely spaced ..... *C. repens*
- 20b. Pedicels ascending at anthesis, the flowers somewhat clustered .....  
..... *C. alpina* subsp. *imaicola* × *C. repens*
- 19b. Pedicels glabrous ..... *C. alpina*
- 18b. Nectary exerted beyond the opening of the floral tube as a low, fleshy, ringlike disc .... 21
- 21a. Nodes deep purple; eastern Asia ..... *C. × mentiens*
- 21b. Nodes pale purple or green; widespread in Europe and North America, rare in eastern Asia ..... *C. × intermedia*

## KEY TO CIRCAEA IN NORTH AMERICA

- 1a. Flowers opening after elongation of the raceme axis, more or less loosely spaced, borne on spreading pedicels; fruits obovoid to pyriform or the fruits sterile and aborting shortly after anthesis ..... 2

- 2a. All, or nearly all, ovaries developing to maturity; fruit with corky thickened ribs separated by deep grooves; pollen highly fertile ..... *C. lutetiana* subsp. *canadensis*
- 2b. All ovaries aborting shortly after anthesis, very rarely a few persistent after anthesis; fruit, when somewhat persistent, with only low ribs and with shallow grooves; pollen highly sterile ..... *C. × intermedia*
- 1b. Flowers opening before elongation of the raceme axis, clustered and corymbiform at the apex of the raceme, borne on erect or ascending pedicels; fruits clavate ..... 3
- 3a. Plants with at least a few, recurved, falcate hairs on the stem; leaves subentire or very minutely denticulate, rounded to truncate, rarely subcordate at the base .....  
..... *C. alpina* subsp. *pacifica*
- 3b. Plants with the stem completely glabrous; leaves prominently denticulate to serrate, cordate, rarely rounded at the base ..... *C. alpina* subsp. *alpina*

KEY TO *CIRCAEA* IN EUROPE

- 1a. Axis of inflorescence elongating before the flowers open; the flowers on spreading or slightly ascending pedicels; rhizomes without terminal tuberous thickenings; nectary exerted beyond the opening of the floral tube ..... 2
- 2a. Plants fertile with full fruit set and with more than 70% filled pollen grains ..... 3
- 3a. Fruit with deep sulci and prominent ribs, obovoid, pyriform or globose; stem glabrous; primarily from Moscow in the U.S.S.R. eastward .....  
..... *C. lutetiana* subsp. *quadrisulcata*
- 3b. Fruit without deep sulci and prominent ribs, clavate to obovoid, stem commonly pubescent; primarily from Moscow westward throughout Europe and in southwestern Asia, North Africa ..... *C. lutetiana* subsp. *lutetiana*
- 2b. Plants sterile, rarely setting fruit and with fewer than 2% filled pollen grains .....  
..... *C. × intermedia*
- 1b. Axis of inflorescence elongating after the flowers open; the flowers on erect or ascending pedicels; rhizomes with terminal tuberous thickenings; nectary wholly within the floral tube .....  
..... *C. alpina* subsp. *alpina*

**1. *Circaea cordata* Royle, Illustr. Bot. Himal. 211, t. 43, fig. 1, a-i. 1834.—FIG. 3.**

*Circaea mollis* sensu Maximowicz, non Siebold & Zucc., Prim. Fl. Amur. 105. 1859.

*Circaea cardiophylla* Makino, Bot. Mag. Tokyo 20: 42. 1906. TYPE: Japan, Honshu, Prefecture Tokyo, Dokan-yama, T. Makino MAK 6904 (MAK, lectotype).

*Circaea bodinieri* H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 224. 1912. nom. provis.

*Circaea × hybrida* Hand.-Mazz., Symb. Sin. 7: 605. 1933. TYPE: China, Yunnan, Mekong-Salwin divide, 28°10' N. Lat., September 1914, G. Forrest 13254 (E, holotype).

*Circaea kitagawae* Hara, J. Jap. Bot. 10: 595. 1935. TYPE: China, Hopeh, Ch'engte ("Manchuria, Jehol"), between Hsing-lung-t'ang and Pei-ying-fang, 27 August 1933, T. Nakai, M. Honda & M. Kitagawa (TI, holotype).

Plants usually robust, 2–15 dm tall, simple or, more commonly branched above, forming numerous, often branched, non-tuberous rhizomes, which give rise to the following year's plants from their tips. Plants pubescent, usually densely so. The stems with long, patent or slightly bent, sharp-pointed, soft hairs, 0.5–1.4 mm long, soft, short, falcately recurved hairs, 0.2–0.3 mm long, and short, capitate and clavate-tipped glandular hairs, 0.2–0.4 mm long, the ratios of these hair types varying greatly between populations. The axis of the inflorescence with hairs as on the stem but more often with a greater proportion of short, falcately recurved and glandular hairs. The petioles with hairs as on the stem but with the falcate hairs upwardly curved. The leaves with long straight hairs, 0.4–1.1 mm long, along the veins, and commonly also on the interveinal areas, on both surfaces, the shorter, straight hairs often appearing strigillose in pressed specimens, also with falcate hairs and long, straight hairs along the margin. Stems green. Leaves horizontally spreading, drooping at the tips, green, opaque. Median leaves the largest, 4–11(–13) cm long, (2.3–)3.5–7(–11) cm wide. Leaves becoming gradually reduced in size upward to the base of the inflorescence and ultimately bract-

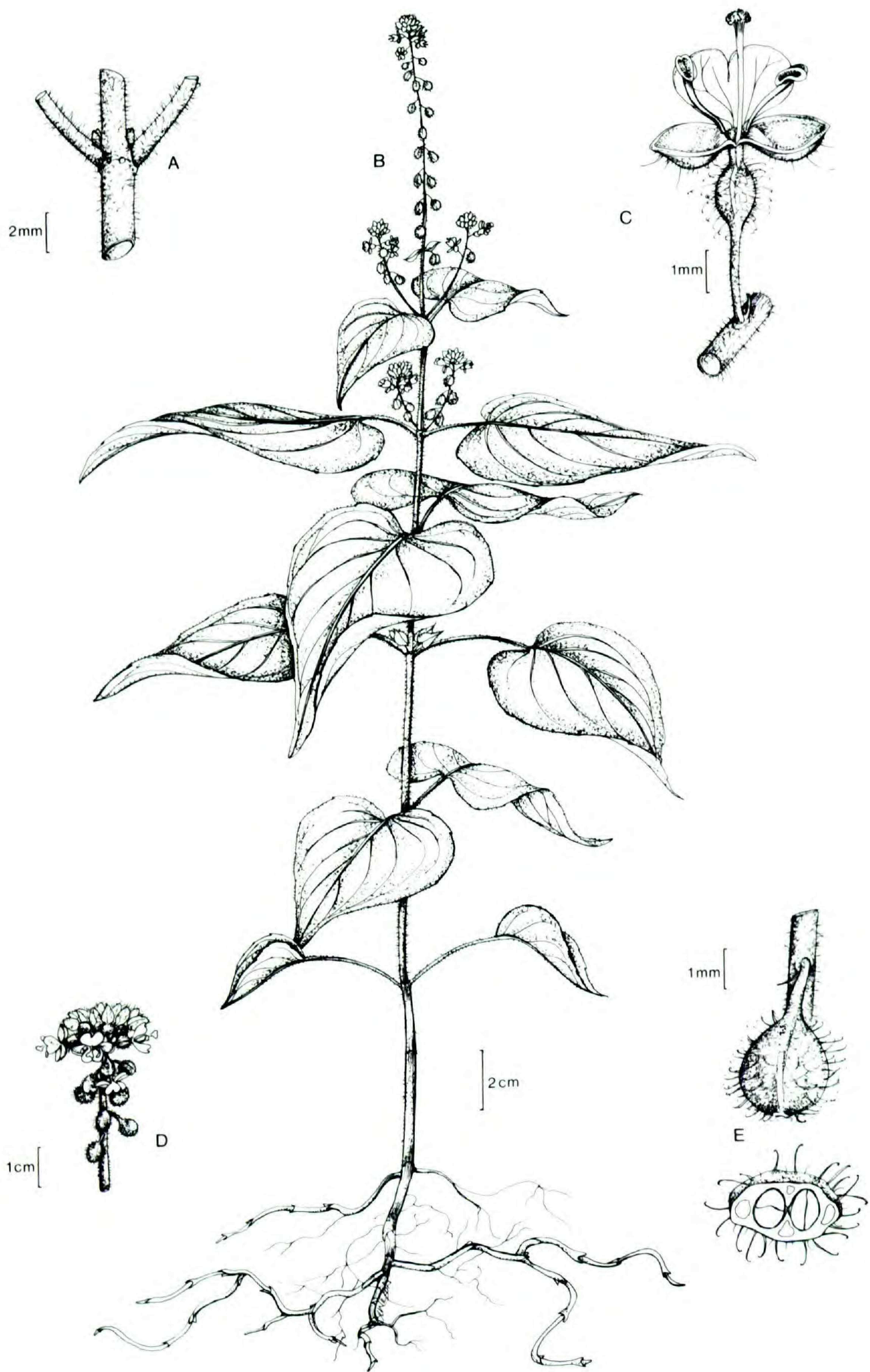


FIGURE 3. *Circaea cordata* Royle.—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note absence of exerted nectary.—D. Inflorescence.—E. Fruit. From *Boufford et al.* 19575 (CM, KYO, MHA, MICH, MO, NCU, S).

like and alternate, gradually reduced in size downward (although not often apparent since the lower leaves are usually deciduous by flowering time). Leaves narrowly to very broadly ovate, short acuminate, very broadly cuneate, broadly rounded to truncate or, more commonly, cordate at the base, denticulate to subentire. Petioles terete, (1-)2-7(-10) cm long, with, or occasionally without, reduced branches arising in the axils. Inflorescence densely pubescent with short, soft, falcately recurved hairs and with short, capitate and clavate-tipped, glandular hairs, often with irregularly occurring, long, straight or slightly bent hairs intermixed; terminal on the main stem and at the tips of the short, uppermost axillary branches or occasionally the lateral racemes arising directly from the uppermost leaf axils. The racemes simple or the terminal, less often the laterals, freely branched near the base. The terminal raceme, from the uppermost reduced leaf or leaf-like bract, ca. 2 cm long at initiation of flowering, to 20 cm long at cessation of flowering; lateral racemes ca. 2 cm long at initiation of flowering, to 15 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels 0.7-2 mm long, perpendicular to the axis of the raceme at anthesis and  $\pm$  clustered, pubescent, with capitate and clavate-tipped glandular hairs 0.1-0.2 mm long, intermixed with long, straight, sharp-pointed soft hairs, 0.4-0.9 mm long, occasionally also with uncinata hairs as on the ovary; with a minute setaceous bracteole, 0.4-1 mm long at the base. Fruiting pedicels 1.5-2.8 mm long. Buds pubescent, rarely subglabrous, with few to many long, straight or slightly curved, rarely hooked, hairs, 0.4-1.1 mm long, and with straight, capitate and clavate-tipped glandular hairs, 0.1-0.2 mm long; green or white; narrowly to broadly elliptic to obovoid, smoothly rounded to the obtuse apex; from the summit of the ovary, 2.5-4.3 mm long, 1.3-2 mm thick just prior to anthesis. Ovary 1-1.5 mm long, 0.6-0.9 mm thick at anthesis, broadly elliptic to subcircular in outline, often obliquely rounded to the pedicel, dorsally flattened, very densely pubescent with translucent or white, soft, uncinata hairs. Floral tube 0.6-1 mm long, 0.2-0.4 mm thick at the narrowest point, funnelform to broadly so, sometimes tapering concavely to the base, pubescent, with short, capitate and clavate-tipped, glandular hairs, 0.1-0.2 mm long, and sometimes also with long, straight hairs as on the buds. Sepals 2-3.7 mm long, 1.4-2 mm wide, pubescent abaxially with hairs as on the buds, white or pale green; ovate to broadly so, broadly to narrowly rounded to the obtuse apex; reflexed in flower. Petals 1-2.4 mm long, 1.2-3.1 mm wide, wider than long, white, depressed obovate to very broadly obovate in outline, the apex obcordate; the apical notch 0.5-1.9 mm deep,  $\frac{1}{2}$ - $\frac{2}{3}$  the length of the petal, the petal lobes broadly rounded; the petals broadly rounded to the usually short clawed base. Stamens spreading at anthesis, shorter than, to equalling the style; filaments 1.5-3.5 mm long; anthers 0.5-0.7(-1) mm long, 0.3-0.6 mm thick. Style straight, erect or slightly depressed at the tip, 3-5(-5.5) mm long, topped by an obtriangular to transversely oblong, bilobed stigma, 0.2-0.3 mm tall, 0.5-1 mm thick. Nectary wholly within the floral tube and inconspicuous. Mature fruit 3-3.9 mm long, (1.8-)2.2-3.3 mm thick, bilocular and 2-seeded, obliquely obovoid to lenticular, dorsally flattened, broadly rounded at the apex, truncate or, most often, obliquely rounded to the pedicel; with low, corky thickenings along the margins and between the locules, without prominent sulci; densely covered with stiff, translucent, uncinata hairs, 0.8-1.2 mm long,

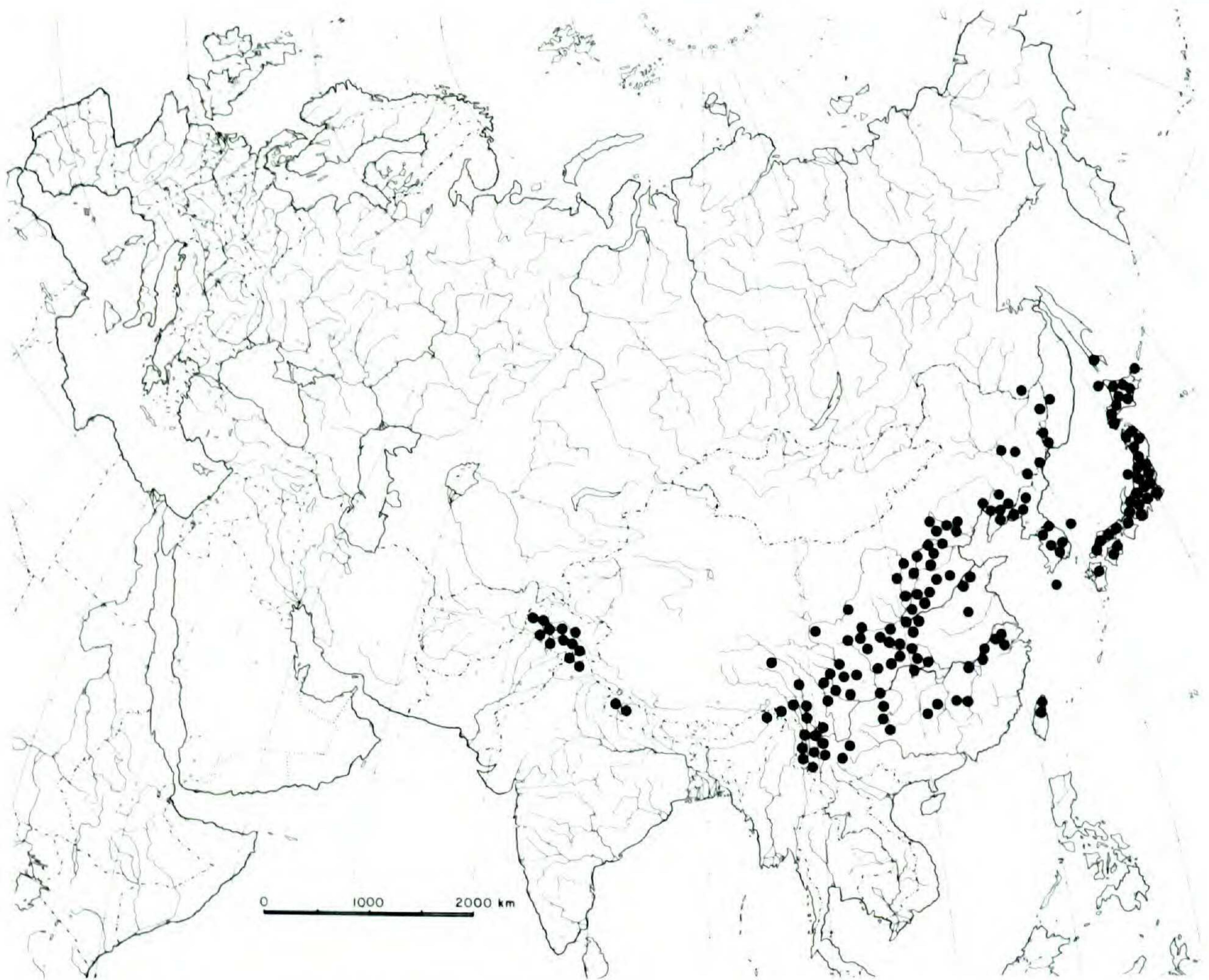


FIGURE 4. Distribution of *Circaea cordata* Royle.

and with fewer, often hidden, capitate and clavate-tipped glandular hairs, 0.1–0.2 mm long. Fruiting pedicels reflexed, often sharply so. Combined length of pedicel and mature fruit, 4.4–7 mm long. Gametic chromosome number,  $n = 11$ .

TYPE: India, Kotgarh, *J. Royle* (LIV, lectotype; photograph at MO. K, probable isolectotype).

Distribution (Fig. 4): Dry mesic slopes and well drained soils in mixed deciduous forests, barely extending into the southern part of the transition zone between deciduous and boreal forests. Japan; southeastern Siberia, Korea, and northeastern China, southwestward to Sichuan and Yunnan, China, and Assam, India; Nepal; northwestern India to Kashmir and Pakistan; Taiwan. From sea level to 3,500 m. Flowers mid-June to mid-August.

Representative specimens examined:

U.S.S.R.

RUSSIAN S.F.S.R. Vladivostok near Sedanka Station, *S. J. Enander* in 1926 (S); Flora Amurensis, *V. Komarov* in 1895 (LD); Khabarovsk District, along Amur valley, *I. W. Kuznezow* 631 (DS); Vladivostok District, S shore of Lake Chauka, E of Nova-djevilsa, *G. Melvil* in 1926 (DS, S); Sakhalin, Holmsk District, *M. Pimenov* 1095 (DS); Khabarovsk Province, Bikin District, near Bikin, *L. S. Plotnikova* in 1967 (MHA); Kurile Islands, Kunashiri Island, Tretyakova, *A. Schroeter* 915a (MHA); Primorski Province, near Vladivostok, *V. N. Voroshilov* in 1958 (DS).

## ASIA

CHINA. ANHUI: Huang Shan, *S. S. Chien* 1281 (W), *R. C. Ching* 8598 (E, UC, US), *K. S. Chow* 131 (A, K, KYO, MO, NCU, PE); Chiu Hwa Shan, *C. S. Fan & Y. Y. Li* 174 (E, K, NAS); Huang Shan, *T. N. Liou & Tsoong* 2543 (E, PE); Chiuhwa Shan, *S. C. Sun* 1228 (NY); Jung Hsien, *without collector* 458 (NAS). GANSU: Tianshui Hsien, *C. W. Chang* 235 (NAS, PE); Tianchi Shan, *W. Y. Hsia* 5966 (PE); border of E Gansu & N Sichuan, *G. Potanin in 1885* (LE); Huating Hsien, *T. P. Wang* 17007 (PE). GUIZHOU: San-chouer, *J. Cavalerie* 3781 (E, P); Zunyi Hsien, *Guizhou Exped.* 1288 (PE); Dutun Hsien, near Hai-kow, *Y. Tsiang* 5804 (NAS, NY, PE, S, UC, W); Tsun-i, Chinting Shan, *C. C. Tui* 1288 (PE). HEBEI: Beijing, *A. David s.n.* (BM); San Shan, *N. Desoulavy* 580 (LE); Neiqui, *S. Y. Lau* 694 (NAS); Zan-huang, *S. Y. Lau* 823 (NAS); Pingshan Hsien, *A. R. Li* 1149 (PE); Miofeng Shan, *C. F. Li* 72 (PE); Tang Hsien, *K. M. Liou* 3082 (NAS); Fuping Hsien, *K. M. Liou* 3551 (PE); Neiqui Hsien, *X. Y. Liu* 694 (PE); East Tomb, *Y. Liu* 11880 (PE); Neiqui, *Y. Liu* 13030, 13236 (NAS); Moryo-san, *T. Nakai et al. in 1933* (TI); Changshanyü, *T. Nakai et al. in 1933* (TI); Chengde Shi, *Nankai Univ.* 256 (PE); Xiaowutaishan ("Hsiao-wu-t'ai-shan), Tung-lin, *H. Smith* 231 (LD, S, UPS); East Tomb, *T. Tang* 2202 (PE); Xiaowutaishan, *C. W. Wang* 60792 (PE); Yangchia-ping, Xiaowutaishan, *C. W. Wang* 61827 (PE); Trappist Monastery, *C. G. Yang* 171 (PE); Daxing Hsien, *C. G. Yang* 1014 (PE); Yong-ning, *without collector* A418 (S). HEILONGJIANG: opposite Harbin, Siaolin, *Jettmar in 1926* (W); Ch'i-li, P'ai-ta, near Hsuenhwa, *H. Serre* 9523 (W); Rache Hsien, *K. C. Wang* 603, 668 (PE); "Heilongjiang," *Y. Yabe in 1917* (NAS). HENAN: Xixia, *Exped. Henan* 1189, 1273 (NAS); Song Hsien, *Exped. Henan* 2236 (NAS); Mt. Ch'i-feng Shan, *Fr. Hugh in 1899* (BM); Lushi Hsien, *K. M. Liou* 4656, 4705 (PE). HUBEI: Shennongjia, *K. S. Chow* 76112 (PE); Yichang, *W. Y. Chun & S. S. Chien* 5150 (UC); Badong Hsien, *H. C. Chow* 916 (E, NY, PE); Hsing-shan, *A. Henry* 6552 (K); "Hupeh," *A. Henry* 6573 (BM, G, K); Xingshan Hsien, *H. J. Li* 2960, 1139 (PE); Zhuxi, *P. Y. Li* 2970 (NAS); Shennongjia, *Shennongjia Exped.* 32724 (PE); Chiang-yang, *E. H. Wilson* 1545 (E, K, LE, NY, US); Hsing Shan, *E. H. Wilson* 1545 (W). HUNAN: Mt. Yün-shan near Wu-kang, *H. Handel-Mazzetti* 12317 (E, LE, W); Nanyue, *K. C. Kuan & B. M. Yang* 118 (PE); Nanyue, Shang-feng-shih, *Y. Liu* 169 (PE). JIANGXI: Shangyou Hsien, *T. L. Chin* 70537 (PE); Lushan, *K. C. Kuan* 74356 (PE), *A. N. Steward* 2633 (K, MO, NY, UC, US); Kuling, Mt. Lu Shan, *A. N. Steward* 4696 (MT). JILIN: Antu Hsien, *P. Y. Fu* 2595 (PE); Lungtan Shan, *Y. C. Ma* 10144 (PE). LIAONING: Anshan city, Chien-shan-chung kou, *I. L. Chou et al.* 2595 (PE); Anshan, *P. Y. Fu* 2595 (PE); Shenyang (Mukden), *Litvinov* 3173 (GH); Fentei, *Y. Yabe in 1909* (NAS); Quiansha, *Y. Yabe in 1909* (NAS); Caohekou, *Y. Yabe in 1917* (NAS). SHAANXI: Tai hua Shan, *K. S. Hao* 3829 (PE); Huashan, *K. S. Hao* 3927 (PE); Cho-toe-miao, Hu Hsien, *Fr. Hugh s.n.* (BM); Nungshan Hsien, *H. W. Kung* 3130 (PE); Hu Hsien, *P. C. Kuo* 96, 448 (PE); Taibai Shan, *T. N. Liou* 48 (NAS, PE), 1741 (PE); Baoji Hsien, *C. H. Wang* 110 (PE); Lanian Hsien, *T. P. Wang* 16001 (PE); Chungnan Shan, *T. P. Wang* 2103 (PE); Taibai Shan, *T. P. Wang* 1473, 1739 (PE). SHANDONG: Linqu Hsien, *T. Y. Chou* 5304 (NAS); Zibo Hsien, *T. Y. Chou* 5658 (NAS); Tai Shan, *T. Y. Chou* 7202 (NAS), *Exped. Wil. Pl. Shandong* 7122 (NAS). SHANXI: Jincheng Hsien, *S. Y. Bao* 414, 1625 (PE); Huangqu Hsien, *S. Y. Bao* 2067, 2137 (PE); Ruicheng Hsien, *S. Y. Bao* 857 (PE); Fou-p'ing, *L. Chavet* 690 (W); Xing Hsien, *Huanghe Exped.* 2582 (PE); Wutai Shan, *K. C. Kuan & Y. L. Chen* 2520 (PE); Qin Hsien, *K. C. Kuan & Y. L. Chen* 887, 956, 1078 (PE); Lien-nan Hsien, *E. Licent* 2263 (K, W); Wei-tze-p'ing, *E. Licent* 2523 (K, P); Yao-shan, Hsia-ch'uan, *E. Licent* 12550 (W); Lingchuan Hsien, *K. M. Liou* 7621 (PE); Pingting Hsien, *K. M. Liou* 3980 (PE); route of Wu-tai, Yang-t'ao-li, *A. Serre* A690 (UPS); Yuan-chu, Yang-shu-ling, *H. Smith* 6163 (S, UPS); Yuan-chu, Shui-wang-p'ing, *H. Smith* 6736 (UPS); Chieh-hsiu, Ch'o-mei-shan, *H. Smith* 7619 (LD, S, UPS); Xi Hsien, Shilo Shan, *T. P. Wang* 3055 (K, PE); Huo Hsien, *T. P. Wang* 3967 (PE). SICHUAN: Fenjie Hsien, *C. C. Chang* 25720 (PE); Nanchuan, *T. Y. Chang* 5720 (NAS); Fenjie, *H. F. Chow* 26941 (NAS); Mao Hsien, *H. F. Chow* 26941 (PE); Baoxing Hsien, *K. L. Chu* 3664 (BM, E, PE); Dunggo, *K. L. Chu* 7855 (PE); Chengkou Hsien, *T. L. Dai* 101867, 104176, 105726, 105913 (PE); "Tchen-keou," *R. P. Farges s.n.* (P, US); Li Hsien, *C. Ho* 5770 (NAS); Shimian Hsien, *C. C. Hsieh* 42285 (PE); Kangding, *C. P. Huang* 988 (PE); Mt. Emei Shan ("Uo-mi-san"), *Fr. Hugh in 1899* (BM); Heichui, *H. Li* 23747, 23780 (NAS); Dajin, *H. Li* 78052, 78224, 78638 (NAS); Nanchuan, *K. F. Li* 63456 (NAS), 63482 (NAS, PE); Chengkou, *P. Y. Li* 3725 (NAS); Heishui Hsien, *X. Li* 73747, 73780 (PE); Dajin Hsien, *X. Li* 77977 (PE); Nanchuan, *C. Pei* 8198 (NAS); between Baor & Tha, *H. Smith* 4893 (S, UPS); Chengkou, *T. L. Tai* 103177, 104176, 105913 (NAS); SE of Mao Hsien, *F. T. Wang* 21907 (G, PE); N of Chengdu Plain, *F. T. Wang* 22108 (G); Nanchuan, *F. T. Wang* 22108 (NAS); Chengdu, *F. T. Wang* 22108 (PE); Leipo Hsien, *T. T. Yü* 3401, 3685 (PE). TAIWAN: Taichung Hsien, Chika, *T. C. Huang & C. F. Hsieh* 7281 (TAI); Taichung Hsien, Li Shan, *G. Ikeda* 1712 (KAG); Hsinchu Hsien, Ta-pa-chien-shan, *C. S. Kuoh* 3227 (TAI); Taichung Hsien, Wuse ("Use"), *E. Matsuda s.n.* (TAIF); Hualien Hsien, inside Taroko, *E. Matsuda in 1918* (TAIF, TI); Hualien Hsien, from Karen to Goken-yama-ako, *T. Namba et al.* 2215 (TI); Ilan Hsien, Kizan, Kwan-zan Pass, *S. Okamoto in 1938* (KYO); Nantou Hsien, Musha, Mt. Ali Shan, *W. R. Price* 810 (K); Taichung Hsien, near Wuse, *R. R. Ream* 515 (G); Nantou

Hsien, Taityu, Musya, *S. Sasaki in 1919* (TAI); Hualien Hsien, Nang-kao-shan, *S. Sasaki in 1922* (TAI); Chi-lai-shan, *S. Sasaki in 1926* (TAI); Taichung Hsien, Ma-ni-ko-an, *S. Sasaki in 1930* (TAI); Sa-la-ma-o, *S. Sasaki in 1932* (TAI); Tagiri, *S. Sasaki in 1932* (TAI); Hualien Hsien, *T. Suzuki 16137* (PE); Taichung Hsien, Huan-shan, *M. Tamura 21023* (SHIN); Taichung Hsien, Mt. Hsueh-shan, between Huan-shan & Shikayo-to-shan, *M. Tamura 21037* (SHIN, TI); Nantou Hsien, Musya-santinojo-onsen, *without collector 2096* (TAI); Hualien Hsien, Neng-kao-shan, *without collector in 1922* (TAI). XIZANG: Zayu Hsien, *Qinghai-Xizang Exped. 73727* (PE). YUNNAN: San-chuang, *J. Cavalerie 3781* (K); Yangpi, *Chungtien Exped. 63-4119* (KUN); Houang-li-pin, *J. M. Delavay in 1887* (P); Kan-hai-tzu, *J. M. Delavay in 1888* (A); Ta-lung-tan, *J. M. Delavay 4194* (K, MO, P, TNS, W); region of Ping-tchouan, *F. Ducloux 7113* (P); Atungtze, *K. M. Feng 23615* (KUN); E flank, Lichiang Range, *G. Forrest 2754* (E); SE of Tengyueh, *G. Forrest 8331* (E, K); Mekong-Salwin divide, *G. Forrest 13254* (E); near Tengyueh, *G. Forrest 24798* (E, G, K, NY, US); Chungtien, *H. Handel-Mazzetti 4813* (W); Tse-kou, *Monbeig 101* (E, K), *1912* (P), *R. P. Soulie 1188* (G, P), *R. P. Soulie s.n.* (BM, DS, E, G, K, P, US); Kunming, *Stat. Kunming 55222* (NAS); Che-tse-lo, *H. T. Tsai 58483* (A, PE); Weipo Shan, Menghwa, *Y. Tsiang 11904* (NAS); Weixi Hsien, *C. W. Wang 67929* (A, NAS, TAI), *88223* (NAS), *68223* (A, PE); Degen Hsien, *C. W. Wang 69110* (PE); Huan-fu-ping, Atuntze, *C. W. Wang 69110* (A, NAS); Shun-ning, Wumulung, *T. T. Yü 16582* (A, E); Chenkang, Montung, *T. T. Yü 17475* (A, E). ZHEJIANG: Hsi-tian-mu Shan, *S. S. Chien 661* (NAS); Tianmu Shan, *H. C. Chu 365* (NAS), *S. Y. Ho in 1957* (NAS), *Y. Y. Ho 25339, 25494, 25576* (NAS), *W. Y. Hsia 202* (PE), *K. C. Kuan 75467* (PE); Hsi-tian-mu-shan, *Y. W. Law 1166* (K, NAS, PE, TAI); Tian-mu-shan, *H. C. Liu & W. C. Cheng 5034* (K), *T. N. Liou 6594* (PE); Hsi-tian-mu-shan, *H. Migo in 1930* (NAS), *H. Migo in 1935* (TI). "MANCHURIA": around Ichi-si-da-gou, *V. Komarov in 1897* (BM, LE, P); around Pada-gou, *V. Komarov in 1897* (G, LD, NY); Mukden, near Imperial Tombs, *D. Litvinov 3173* (G, NY); Popiet, *C. Maximowicz in 1860* (K); "Port May," *C. Maximowicz in 1860* (BM, K, L, NY, P, S, US, W); Utsentientze, *B. V. Skvortsov in 1927* (G); Anto Prov., Soukakou, *I. Yamatsuta 947* (TNS). LOCALITIES UNKNOWN: Ying-ning, Pai-t'a, *L. Chavet 418* (W); Mt. Miao-wang-shan, Mt. No-mi-shan, *Fr. Hugh in 1899* (BM); plain of Hua kia Hsien, *Fr. Hugh in 1898* (BM); Sokako, *M. Kitagawa in 1926* (TI); "Western China," *E. H. Wilson 4461* (A, K); Kosei-sho, Kyuko-fu, Mt. Rozan, *without collector 81* (TI).

INDIA. Dalhousie, *C. B. Clarke 22842, 22592* (K), *23029* (BM); Chamba State, Pangi, below Sanch, *J. F. Duthie in 1899* (CAS); near Simla, *Jacquemont herb. 2408* (K); Punjab, Dalhousie, *W. Koelz 8880* (NA); Di Chu (also at Rima), *F. Kingdon-Ward 20043* (BM, E); NW Himalaya, 7-8,000 ft, *T. Thomson s.n.* (GOET, K, L). KASHMIR: Chamba State, Bassued Forest, Chanju Valley, *J. H. Lace 1981* (DS, E); Tangmarg, *R. R. Stewart 10568* (NY, PENN); Palgam, Liddar Valley, *J. F. Duthie 13168* (BM); vicinity of Palgam, on E Liddar road, 27 road mi. N of Islamabad, *F. G. Dickason 762* (MICH); in central mountains (Pir Parg, Gulmay, etc.), *J. R. Drummond 15042* (E); Palgam, *C. B. Clarke 31143* (K), *R. R. Stewart 9233* (NA), *Stewart 21600a* (K, NY, US).

JAPAN. HOKKAIDO. Sapporo, *S. Arimoto in 1903* (G), *Arimoto in 1902* (MO); Rishiri Island, Higashi-rishiri-cho, Omobetsu-zawa, *D. E. Boufford & E. W. Wood 19822* (CM, KYO, MHA, MO); Hidaka Shicho, Samani-gun, Samani-cho, Okada, *D. E. Boufford & E. W. Wood 19699* (BM, CM, E, G, K, KYO, LD, MHA, MO, NCU, P, PE, SHIN); Ishikari Shicho, Sapporo, Mt. Maru-yama, *D. E. Boufford & E. W. Wood 19631* (KYO, MO); Sapporo, Mt. Teine-yama (CM, MHA, MO); Kawakami Shicho, hwy 40 just WNW of Osashima at the border of Nakagawa-cho, *D. E. Boufford & E. W. Wood 19831* (CM, KYO, MO); Otaru, *U. Faurie 1183* (G, MO), *1189* (P), *2905* (P); Rebun-shiri, *U. Faurie 2628* (G, P); vicinity of Junsainuma, *U. Faurie 6307* (BM); forests of Kamikotan, *U. Faurie 6311* (KYO); Ishikari Shicho, Mt. Moiwa, *Fujita et al. in 1928* (SAPA); Hakodate, *F. C. Greatrex 382* (SAPA); Sapporo, Mt. Maru-yama, *M. Hara in 1943* (TI); Sapporo, *S. Hori in 1885* (MAK); Mt. Iyozankei-tengu, *K. Ito in 1969* (SAPA); Oshima, Fukuyama, *T. Kawakami in 1892* (SAPA); Rishiri Island, Mt. Rishiri, *T. Kawakami in 1899* (SAPA), *G. Koidzumi 32* (KYO); Nopporo, *Y. Kudo in 1915* (TUS); Rishiri Island, Oshidomari, *T. Makino in 1903* (MAK 6903); Iburi-gun, Lake Toya-ko, *T. Makino s.n.* (MAK 6908); Mt. Raiden, *A. Masuda in 1967* (SAPA); Uoiwa, *J. Matsumura in 1899* (TI); Hakodate, *C. Maximowicz in 1861* (BM, G, K, LE, P); Mt. Horoiwa, Lake Saroma-ko, *T. Misumi in 1953* (SAPA); Sapporo, *K. Miyabe in 1891* (MO); Zenibako, Ohirobeshi, *K. Miyabe in 1890* (SAPA); Oshima, Sawara, *K. Miyabe in 1890* (SAPA); Sorachi, Sorachibuto, *K. Miyabe in 1891* (SAPA); Soumbetsu, *K. Miyabe & M. Tatewaki in 1925* (SAPA); Oshima, Ishizaki, *K. Miyabe & Y. Tokubuchi in 1890* (SAPA); Ishikari, Jozankei, *H. Muramatsu in 1928* (TI); Kitami, Rubeshibe-cho, Tokoro-gun, *G. Murata & Y. Momotani in 1955* (KYO); Nemuro, Akeshi, *S. Okamoto 963* (KYO); Tokachi, Dekubetsu, *S. Okamoto in 1955* (KYO); Mombetsu-gun, Takinowe, Penke, *S. Okamoto in 1952* (KYO); Rishiri Island, *S. Okamoto 1725* (KYO); Kitami, *S. Okamoto in 1958* (KYO); Tokachi, Kami-ashi-yori, *S. Okamoto in 1955* (KYO); Ishikari, Mt. Moiwa, *T. Sakamura in 1912* (TAI); Biei to Matsuyama, *K. Tagashi in 1918* (SAPA); Shiribeshi, Zenibako, *Takee & Murayama in 1931* (SAPA);

Kushiro, Lake Kutcharo, *M. Tatewaki* in 1933 (SAPA); Sapporo, *E. Tokubuchi* in 1887 (G, NY); Oshima, Junsainuma, *Y. Tokubuchi* in 1888 (SAPA); Shiribeshi, Yoichi, *I. Yamamoto* 4248, 4471 (KYO); Akkeshi, near Rinkaijikenjo, *T. Yamanaka* in 1936 (SAPA); beside Lake Akkeshi, *T. Yamanaka* in 1936 (SAPA); Mt. Teine-yama, *H. Yanagirawe* in 1915 (SAPA); Sapporo, *R. Yatabe* 1882 (G, TI), *Class of '80* in 1978 (SAPA), *Class of '27* in 1927 (SAPA). HONSHU. AICHI PREFECTURE: Tomiyama-mura, Ichibara, *K. Torii* in 1954 (TNS); Mikawa, Mt. Ishimaki, *T. Tsunekawa* in 1941 (TNS). AKITA PREFECTURE: Kazuno-gun, Shihei-mura, *S. Kurosawa* in 1951 (TI); Oga Peninsula, Monzen, *R. Mochizuki* 2110 (KANA); Mt. Moriyoshi, *H. Muramatsu* in 1931 (TI); Yokote, Masudamachi, *K. Yushun* in 1905 (NY). AOMORI PREFECTURE: plains of Aomori, village of Takata, *U. Faurie* 1124 (MO, P); Shimokita Peninsula, Mt. Osore-yama, *M. Mizushima* 15205 (MAK, S). CHIBA PREFECTURE: Kimitsu-gun, Kameyama-mura, *M. Furuse* in 1962 (A); Ninomiya, Tsudanuma (TNS 103100). FUKUSHIMA PREFECTURE: Mt. Iitomi-yama, *R. Endo* in 1913 (TUS); Mt. Azuma, Hibara Pass, *G. Koidzumi s.n.* (TI); Kita-aizu-gun, Wakamatsu city, from Agaiyachi to Nababashi, *S. Kurosawa* in 1957 (TI); Yumoto, *J. Matsumura* in 1978 (TI); Numayama Pass, *G. Nakahara* (MAK 6906); Minami-aizu-gun, *J. Ohwi & M. Tagawa* 462, 493, 596 (KYO); Aizu, Numayama Pass (MAK 117708). GIFU-NAGANO PREFECTURES: Mt. Norikura, *U. Faurie* 6680 (BM, KYO, P). GUNMA PREFECTURE: Maru-ike Lake, *T. Makino* in 1930 (MAK 6917 (KAG, KYO, MAK, S)); Tano-gun, Nakasato-mura, Nakasato, *T. Masahisa* in 1957 (TNS). HIROSHIMA PREFECTURE: Nanbarakyo Gorge, *T. Makino* in 1928 (MAK 7053 (KANA, MAK, S)). HYOGO PREFECTURE: Yabu-gun, Oya-cho, Ikada, *D. E. Boufford et al.* 19575 (CM, KYO, MHA, MICH, MO, NCU, S); Mikata-gun, Onsen-cho, Kiri-taki waterfall, *D. E. Boufford et al.* 19597 (CM, KYO, MHA); Taki-gun, Tannan, Mt. Ryusoji, *S. Hosomi* 8837 (KYO); Mayasan, Rokukosan no uchi, *Ishikawa* in 1937 (TAI); Sakanotani, Government Forest near Tokura, *T. Kodama* 12446 (TNS); Mikata-gun, Onsen-cho, Kiri-taki waterfall, *G. Murata* 20694 (KYO); Asago-cho, SW of Nii, Toji, Hashigatani, *M. Tagawa* 7061 (KYO); Kamaguchi-mura, Myoken, Awaji Island, 8 August (TI). IBARAGI PREFECTURE: Mt. Yamigo, *S. Masatomo* in 1962 (TNS); Higashiibaragi-gun, Nagaokamura, *K. Tsurumachi* in 1916 (TNS); Mito city (MAK 6907); Tsuchiura (MAK 117709). IWATE PREFECTURE: Hiramiwa-toge, *S. Kitamura* in 1965 (KYO); Mt. Hayachine, Shimohei-hien-uki-gun, *T. Makino* in 1928 (MAK 6915 (MAK, S)). KANAGAWA PREFECTURE: Tsukui-gun, Mt. Shiro-yama, *S. Kobayashi* in 1955 (S). KYOTO PREFECTURE: cultivated in Tokyo Univ. Bot. Gard., *S. Kawagoe* in 1909 (KAG). MIYAGI PREFECTURE: Oni-kubi, *K. Hosoi* in 1949 (KANA); Mt. Zao, *A. Kimura & S. Sugaya* in 1953 (TUS); Mt. Fubo, Namari-zawa, *K. Sohma* 1531 (KYO, MO, TUS); Ishinomaki city, Fudosawa (MAK 117707). NARA PREFECTURE: Mt. Karakasa-zan, *E. Kitagawa* 2 (TNS). NAGANO PREFECTURE: Suwa-gun, Okaya-shi, Yoko-kawa-dani, *D. E. Boufford et al.* 19623 (CM, KYO, MO); Minamisaku-gun, Mt. Goza, Yamaguchi-michi, *H. Hara* in 1958 (TI); Minamisaku-gun, Kawakami-mura, en route from Senjogahara to Mt. Mikuni-yama, *M. Hotta* in 1958 (KYO); Shimotakai-gun, Sakai-mura, Kitanogami-jinja, *H. Kanai* in 1962 (TI); Mt. Taro, Ueda, *S. Mochizuki* 128 (SHIN); Susuwatari-kue, *S. Momose* in 1933 (TI); Ukawairi, from Susawatari to Higashisawaguchi, *S. Momose* in 1934 (TI); Mt. Hachibuse, *S. Momose* in 1936 (TI); Todai, Kamiina-gun, Miwa-mura, *G. Murata* 8004 (KYO); Ooshika-mura, Mt. Odaka, *M. Muramatsu* 1508 (TNS); Ooshika-mura, Tokokuchi-yama, *M. Muramatsu* 1903 (TNS); Kizawa-mura, Nishisawado, *M. Muramatsu* 2627 (TNS); Kami-ina-gun, Todai, *J. Ohwi* in 1929 (KYO); Ii-yama, *T. Saito* in 1906 (MAK); Minamisaku-gun, Nakagome-cho, Kuroda, *K. Sato* 154 (TI); Kita-aiki-mura, Mt. Goza, *K. Sato* 607 (TI); Chiisata-gun, Kakuma Valley at the foot of Mt. Eboshi, *T. Shimizu* 19721 (SHIN); Yokokawadani Valley, Okaya, *T. Shimizu* 25817 (SHIN); Yakeyamazawa, Utsukushigahara, *S. Suzuki* 492 (K); Shimoina-gun, Kisawa-mura, Toyama-gawa, *Yamasaki et al.* in 1954 (TI); near Komoro city, Mt. Nonobiki (MAK 117713); Mt. Tadeshima (MAK 117714); Chiisata-gun, Nagata-cho, Honzawa (MAK 117716). NIIGATA PREFECTURE: Mt. Kurochima, *T. Ajime* 4313 (KANA); foot of Mt. Yosen, *U. Faurie* 212 (P); Sado Island, Ikawa, Tasha, *Y. Ikeyama* 46402 (KANA); Sado Island, Ishina, *F. Maekawa* in 1933 (TI); Sado Island, *T. Makino* in 1933 (MAK 6918 (KAG, MAK, S)); Mt. Todaramine, *G. Murata* 6736 (KYO); Nishikubiki-gun, Odaki-mura, *S. Uchikawa* in 1953 (TNS); Higashikanbara-gun, Tsugawa, *T. Yamazaki* (TI); Itoigawa city, Mt. Myojo (KANA 085749). OKAYAMA PREFECTURE: Maniwa-gun, Katsuyama-cho, Kanba waterfall, *T. Shimizu* in 1958 (KYO). OSAKA PREFECTURE: Mt. Iwawaki, *M. Tagawa* 3309 (TNS). SAITAMA PREFECTURE: Okutama, Korikawa, *H. Kanai* 1817 (TI); Chichibu city, *T. Makino* in 1920 (MAK); Inuma-gun, Naguri-mura, Shiraiwa, *H. Ohashi et al.* in 1975 (TI). SHIGA PREFECTURE: Kanzaki-gun, Yama-no-ue village, Ainotani, *T. Hashimoto* in 1932 (KYO). SHIZUOKA PREFECTURE: Akaishi Mts., Mt. Toyoguchi, *Furusawa & Kuraishi* in 1953 (TI); Izu Peninsula, Kamogun, Nando-mura, *Y. Kimura* in 1943 (TI); Akaishi Mts., Oshika-mura, Koshibu-gawa, *H. Matsuda* in 1953 (TI); Owigawa-joryu, Nakano-yado, *H. Matsuda* in 1954 (TI); Owi-gawa-joryu, Tokusa, *H. Matsuda* in 1954 (TI); Enshu Senzu Government Forest, near Hiryuubashi office, *T. Satow & Y. Hayashi* 7827 (TNS). TOKYO PREFECTURE: Mt. Takao, *M. Honda* in 1925 (TI); Mt. Kariyose, *M. Honda* in 1929 (TI); Musashi, Nishigahara, *T. Kagasawa* in 1885 (TNS); Mt. Takao, *Y. Kobayashi* in 1930 (TI), *Y. Komori* 566 (TI); Yoyogi in Tokyo, *T. Makino* in 1900 (MAK 6912 (MAK, S)); Dokan-yama in Tokyo, *T. Makino* in 1900 (MAK 6913 (S), MAK 6910, 6916, 117711 (MAK)); Mt. Kariyose,



*T. Makino* in 1930 MAK 6919 (KAG, MAK); Waseda, *S. Matsuda* in 1891 (KYO); Zoshigaya, *S. Matsuda* in 1900 (KYO); Nishitama-gun, Mt. Minoto, *M. Mizushima* 10033 (UC); Tokyo, *H. Sakurai* in 1907 (E); Dokan-yama, *K. Watanabe* in 1888 (G); Nishitama-gun, Hikawa-mura, Nippara, *T. Yamazaki* in 1947 (TI); Ueno, *R. Yatabe & J. Matsumura* in 1878 (TI); Mt. Takao (MAK 6905); Uchiai, 20 August 1910 (LD); Yoyogi, Shibuya-ku (MAK 117710), 23 September 1911 (S). TOYAMA PREFECTURE: Tateyama, Ueno-taki, *T. Ichimura* 1440 (KANA); Shimo-shinkawa-gun, Miyazaki-mura, Miyazaki, *H. Kanai* in 1958 (TI); Higashi-tonami-gun, Taira village, Ainokura, *Mimoto, Sugaru & Mori* 12703 (KYO). YAMAGATA PREFECTURE: Higashine city, Makino, *D. E. Boufford & E. W. Wood* 19880 (BM, CM, E, K, KYO, MHA, MO, PE); Owisawa, Naka-mura, Yudono-jinja, *H. Hara* in 1959 (TI); Higashi-murayama-gun, near Yamadera Station, *H. Kanai* in 1959 (TI); Yamagata city, near Kabutoiwa, interior of Yamadera, *H. Ohba* 718033 (MAK, MO); Uzen, Sanbonginuma, *S. Okayama* in 1931 (TNS). YAMAGUCHI PREFECTURE: Nagato, Abu-gun, Koshigahama, Kasayama, *J. Nikai* 389 (TNS); Abu-gun, Higashiwaku-mura, Aza-koshigahama, Mt. Kasayama, *S. Nishina* 389 (TI). YAMANASHI PREFECTURE: Nakakoma-gun, Ashiyasu-mura, Yashajin-toge, *M. Furuse* 19553 (S); Minamitsuru-gun, Nakano-mura, *M. Furuse* in 1959 (A); foot of Mt. Fuji-san, *K. Hiyama* 4003 (TNS); Mt. Kuro-take, *K. Hiyama* in 1933 (TNS); Mt. Amago, Shimobe-onsen, Yunoko-oku, *H. Kanai* in 1955 (TI); Nishiyatsushiro-gun, Okachi-mura, Tsubakizori, *H. Kanai* in 1957 (TI); NNE part of Mt. Fuji-san, Fujiyoshida Sengen-jinja, *G. Murata et al.* 33837 (KYO, MO); Nakakoma-gun, Ashiyasu-mura, *T. Yamazaki* in 1954 (TI). SHIKOKU. KOCHI PREFECTURE: Hata-gun, Taisho-cho, Shimotsui, *Y. Kanematsu s.n.* (MAK 117717); Nano-kawa, 27 July 1892 (G). TOKUSHIMA PREFECTURE: Mt. Tsurugi, *T. Makino* in 1909 (MAK 6909); between Sugeoi and Ochiai, Higashiyama-mura, *G. Murata* in 1954 (KYO); Mt. Takane, *Z. Tashiro* in 1935 (KYO); Shimona-mura, *R. Yatabe* in 1888 (TI). KYUSHU. KUMAMOTO PREFECTURE: Mt. Ohira, *K. Mayehara* 5386 (TI). OITA PREFECTURE: Beppu, *Z. Tashiro* in 1936 (KYO); Hita-gun, Amekata, *K. Hashimoto* in 1927 (MAK).

KOREA, NORTH. Heian-hokudo, Mt. Myoko, *G. Koidzumi* in 1935 (KYO); near the town of Ludzu, *V. Komarov* in 1897 (LE); around Tauanin-dou, Yalu R., *V. Komarov* 1140 (W); Sei-sui-ra, *J. Ohwi* in 1930 (KYO); Heinan-kakigai, 17 July 1916 (TI).

KOREA, SOUTH. Chongju, Chungchong-pukto, *I. C. Chung* 9743 (MICH); Toku-san, Keisho-nando, *T. Mori* 241 (TI); Utsuryo-to Island, *T. Nakai* 4462 (TI); Mt. Kongo, Gunsenkyo, *T. Nakai* 5688 (TI); Kokai, O-aoshima, *T. Nakai* 13300 (TI); Chuhoku, Zokuri-san, Jokan-ando, *T. Nakai* 15081 (TI); Mt. Tii, *S. Okamoto* 27 July 1937 (KYO, TNS), 4 August 1937, 27 August 1937 (KYO); Kogendo, Mt. Kongo, *T. Uchiyama* in 1902 (TI).

KOREA, LOCALITIES UNKNOWN: Kim-o-san, *C. I. Chung* 9936 (MICH); Hoang-hei-to, *U. Faurie* 655 (BM, KYO, P); See Chun Dong, *G. Mills* in 1910 (UC).

A single sheet with only "Mongolia," *A. David* 1889 (P).

NEPAL. NW of Jumla, Chanki, *W. R. Sykes & L. H. J. Williams* 5078 (BM, E, UPS); E of Jumla, Lorpa, *O. Polunin et al.* 4958 (BM, E).

PAKISTAN. HAZARA DISTRICT: 1 mi. from Kawai on way to Shogran, *S. Abedin & M. Qaiser* 8780 (KUH); Murree Hills, Upper Topa, *J. H. Barbour* in 1920 (BM); Hazara, *J. F. Duthie* 21335 (W); Rawalpindi, Murree, *Fleming* 345 (K); Kagan Valley, Kamalban, *A. H. Khan* in 1927 (UC); Murree Hills, *Nasir & R. R. Stewart* 29161 (RAW); Murree Hills, Patriata, *M. A. Siddigi & Y. Nasir* 6076 (RAW); Changla Gali, Murree Hills, *R. R. Stewart* in 1948 (K, PH); Nathia Gali, *R. R. Stewart* 28716 (RAW, SMU); Thandiaru, *R. R. Stewart* 27747 (G). SWAT STATE: Mt. W of Swat R. above Bahrein, *R. J. Rodin* 5558 (RAW, UC, US); Bahrein, *R. R. Stewart* 24479 (BM, NY, W); W Himalaya, *J. F. Duthie* in 1899 (POM, UC).

*Circaea cordata* is one of the most distinct species of *Circaea* and has been the source of little confusion since its recognition by Royle in 1834. The dense, usually spreading pubescence, flowers clustered at the apex of the raceme, short pedicels in flower and fruit, distinctive shape and close spacing of the bilocular, 2-seeded fruits, and the nectary wholly included within the floral tube set *C. cordata* off from all other species of the genus. The absence of an exerted nectary is shared only with *C. glabrescens* among species bearing bilocular, 2-seeded fruits.

Plants with the leaf bases rounded rather than cordate occur sporadically throughout the range of the species but with a higher incidence of occurrence in northwestern India, Kashmir, and Pakistan. A few examples of these plants are

*J. Lace in 1921* (E), *J. Barbour in 1920* (BM), *E. Wilson 1545* (NY), *Y. Tsiang 5804* (S), and *K. Chow 131* (A). Variation in the shape of the leaf base may occur within a population, or even on the same plant as exhibited by *Handel-Mazzetti 12317* (E) from Hunan which has cuneate, rounded, truncate, and subcordate bases. Pubescence is also variable. A few specimens from China and Pakistan have only sparse pubescence on the stem and the long straight hairs are greatly reduced in number. The numerous intergrading populations between these and more typically pubescent plants rule out the possibility of formal taxonomic recognition.

*Circaea cordata* prefers drier habitats throughout its range than any of the other species of the genus. It is often found on dry slopes and on drained, raised areas in alluvial forests.

## 2. *Circaea glabrescens* (Pamp.) Hand.-Mazz., Symb. Sin. 7: 604. 1933.—FIG. 5.

*Circaea cordata* Royle var. *glabrescens* Pamp., in Nuovo Giorn. Bot. Ital. n.s. 17: 677. 1910.

Plants erect or decumbent at the base, 1.2–8 dm tall, simple or occasionally branched below the inflorescence, forming non-tuberous rhizomes that give rise to the following year's plants from their tips. Plants pubescent, rarely glabrous. The stem with short, 0.1–0.3 mm long, soft, falcately recurved hairs; the petioles with short, ca. 0.2 mm long, upwardly pointing, soft, falcate hairs which  $\pm$  continue along the main veins on the lower, and occasionally also on the upper, surface of the leaf, the leaf also with longer, ca. 0.5 mm long, straight, slightly curved or falcate hairs evenly and sparsely distributed over both surfaces, leaf margins with falcate and straight hairs intermixed. Stem green, nodes brownish or those of the inflorescence sometimes reddish purple. Median leaves to those just above the middle of the stem the largest, 3.7–8(–11) cm long, 1.8–5 cm wide. Leaves becoming gradually reduced in size upward from the middle of the stem and then abruptly reduced just below the inflorescence and ultimately bractlike and remaining opposite, or occasionally one or two bracts above these alternate. Leaves gradually reduced in size downward from the middle of the stem. Leaves narrowly to broadly ovate, acuminate to short acuminate, rounded or, very rarely, subcordate at the base, denticulate. Petioles terete, 0.5–4.5(–5.5) cm long, occasionally with reduced branches arising in the axils. Inflorescence glabrous, very rarely sparsely glandular pubescent, terminal on the main stem and rarely at the tips of the uppermost axillary branches, a simple raceme or, more commonly, branched at the base, when branched, the lowest branches opposite and subtended by bracts, the uppermost branches alternate, with, or more commonly, without subtending bracts. Terminal raceme from the uppermost reduced leaf or leaflike bract, or from the uppermost branch at the base of the raceme, 2–5 cm long at initiation of flowering, to 18 cm long at cessation of flowering; lateral racemes ca. 2–3 cm long at initiation of flowering, to 12 cm long at cessation of flowering, subequal length on the same plant. Flowering pedicels 1.3–2.5(–3.3) mm long, perpendicular to the axis of the raceme, glabrous, subtended by a setaceous bracteole, 0.1–0.5 mm long. Fruiting pedicels 2.3–4(–5.5) mm long. Buds glabrous or, more commonly, pubescent, especially at the apex, with a few long, straight to slightly bent hairs, 0.4–0.5 mm long, occasionally also with short

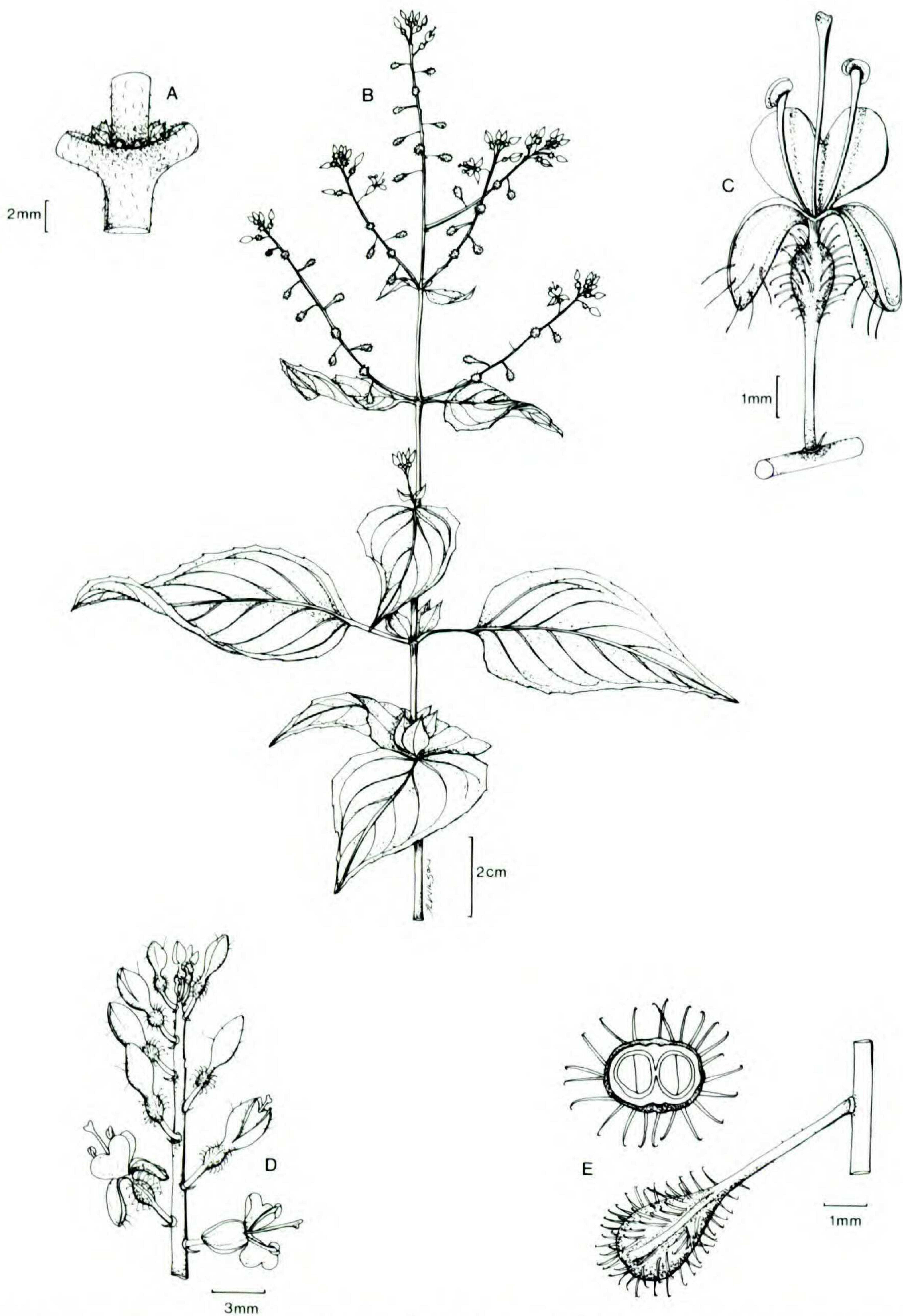


FIGURE 5. *Circaea glabrescens* (Pamp.) Hand.-Mazz.—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note absence of exerted nectary.—D. Inflorescence.—E. Fruit. From *Smith 6492* (LD, UPS).

capitate and clavate-tipped glandular hairs, 0.1–0.2 mm long; pink or pale green; slenderly elliptic to obovoid, acute or obtuse at the apex; from the summit of the ovary, 2.8–3.5(–4.5) mm long, 1.2–1.6 mm thick just prior to anthesis. Ovary 1–1.2 mm long, 0.8–1 mm thick at anthesis, elliptic to obovate in outline, pubescent

with translucent, uncinuate hairs. Floral tube 0.9–1.3 mm long, 0.1–0.4 mm thick at the narrowest point, very slenderly obconic to slender funnelform. Sepals 1.8–3.3 mm long, 1.2–1.7 mm wide, glabrous or, more commonly, pubescent on the abaxial surface with hairs as on the buds, pink or greenish white; oblong to nearly ovate, rounded smoothly from above the middle to the acute or obtuse apex; reflexed in flower. Petals 1–1.9 mm long, 1.3–2.6 mm wide, wider than long, pink, obovate to broadly obovate in outline, the apex obcordate, tapering concavely or short-clawed at the base; the apical notch 0.3–0.6 mm deep, ca.  $\frac{1}{2}$  the length of the petal, the petal lobes broadly rounded. Stamens spreading at anthesis, shorter than the style; filaments 1.6–3.7 mm long; anthers 0.5–0.6 mm long, ca. 0.4 mm thick. Style straight, erect, 3.2–4.7 mm long, topped by an obconic to obtriangular, shallowly bilobed stigma, 0.3–0.4 mm tall, 0.3–0.5 mm thick. Nectary wholly included within the floral tube and inconspicuous. Mature fruit 2.5–3.3 mm long, 1.6–1.8 mm thick, bilocular and 2-seeded, obovoid to obpyriform, rounded at the apex, tapering smoothly to the pedicel, without ribs or sulci but with a shallow groove which represents an extension of the pedicel, densely covered with stiff, translucent, uncinuate hairs ca. 0.9 mm long, except along the extension of the pedicel, and with short, capitate and clavate-tipped glandular hairs ca. 0.1 mm long. Fruiting pedicels horizontally spreading to slightly reflexed at maturity. Combined length of pedicel and mature fruit, 4.5–6(–8.5) mm long. Gametic chromosome number,  $n = 11$ .

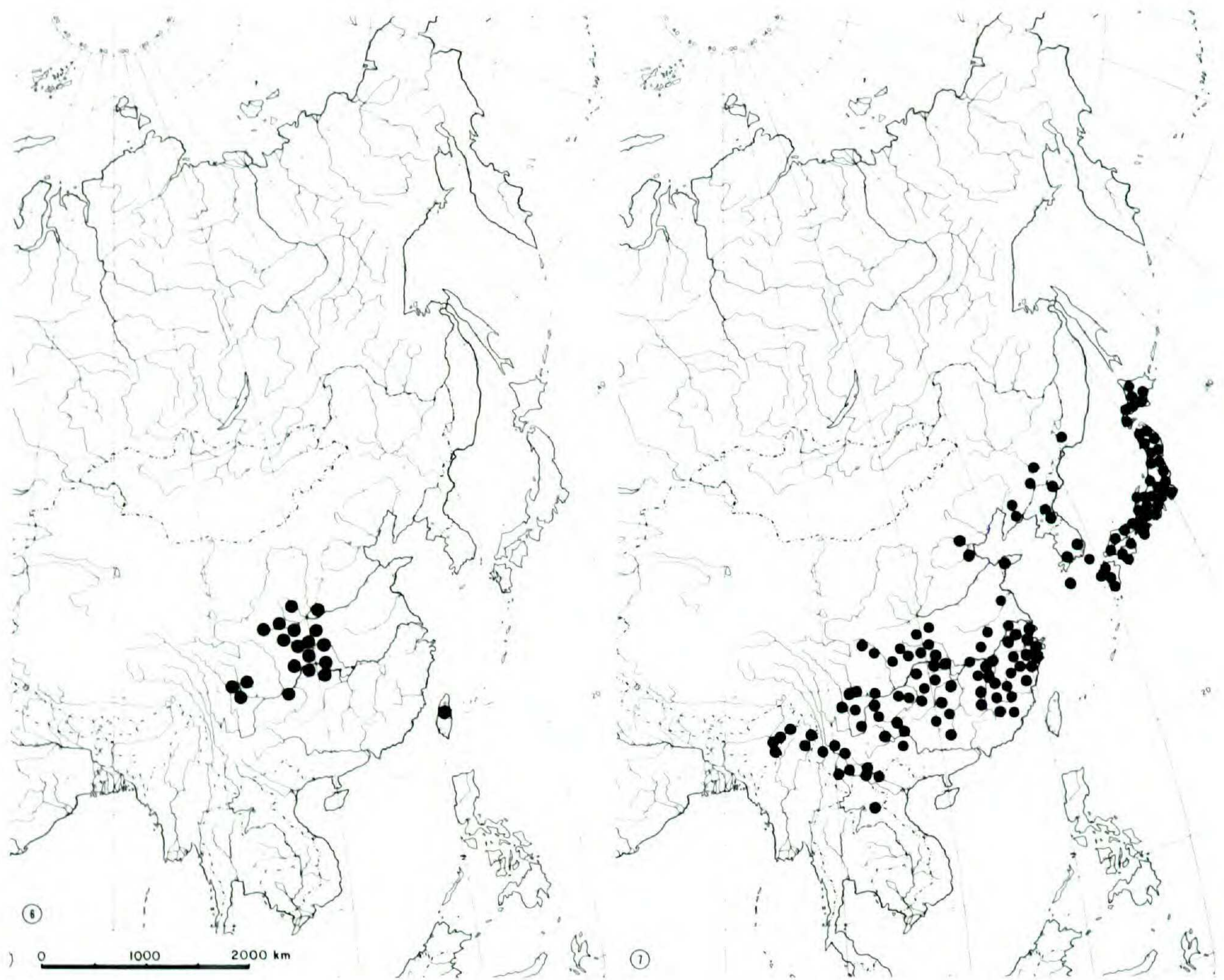
TYPE: China, Hubei, Mts. of Ch'ing-shan-chiang ("Tcin-Scian-Sien"), ca. 700 m. September 1907, *Silvestri 1571* (FI, holotype not seen. BM, DS, photographs).

Distribution (Fig. 6): Deciduous forests. Central China, from western Hubei and northern Sichuan through southern and central Shaanxi to southwestern Shanxi; southeastern Gansu; disjunct to Taiwan (one collection). From 700 to 2,500 m. Flowers, July and August.

#### Specimens examined:

CHINA. HENAN: Lushi Hsien, *L. C. Chen 34609* (PE); Sung Hsien, *L. C. Chen 34966* (PE); Xixia, *Henan Exped. 1164* (NAS); Lushi Hsien, *K. M. Liou 4643* (PE), *K. M. Liou 4710* (G, K, PE). HUBEI: *A. Henry 4851* (E, G, K); "Cien-shih" written on sheet, *A. Henry 6041* (K, P); Hsing-shan, *A. Henry 6498* (BM, GH, K, NY, P, US); Xingshan Hsien, *H. J. Li 83, 610* (PE); Shennongjia, *Shennongjia Exped. 1192, 11309, 20843, 21364, 21486, 31065, 31225, 32214, 32529* (all PE); Chang-yang, *E. H. Wilson 1481* (E, NY, US, W). GANSU: Tianshui Hsien, *W. Y. Hsia 5812* (PE); Tianchi Shan, *W. Y. Hsia 5955* (PE); Pingliang Hsien, *Huanghe Exped. 2067* (NAS, PE); Tianshui Hsien, *K. M. Liou 10066* (PE); Tianshui Hsien, *C. W. Wang 57, 164, 10201* (all PE); Pingliang Hsien, *T. P. Wang 13323* (PE); Pingliang, Kunlun Mt., *K. H. Yüan et al. 2067* (PE); Tianshui, *C. W. Zhang 164* (NAS). SHANXI: Yüan-chu'ü, Shui-wang-p'ing, *H. Smith 6492* (LD, UPS). SHAANXI: Zhouzhi, *S. M. Chang 30* (NAS); Foping Hsien, *K. T. Fu 4999* (PE); Hu Hsien, Cho-toe-miao, *Hugh s.n.* (BM); Ningshen Hsien, *H. W. Kung 3199* (PE); Hu Hsien, *P. C. Kuo 306, 396* (PE); Ankang Hsien, *P. Y. Li 3200* (NAS); Tsingling Mts., *E. Licent 2682* (BM, K, P, W); Taibai Shan, *T. P. Wang 1607* (PE); Shang Hsien, Hei-shan road, Yu-huang-ting, *T. P. Wang in 1952* (PE). SICHUAN: Pao-hsing Hsien, *K. L. Chu 3403* (BM), *3404* (W); Omei Hsien, *W. P. Fang 2805* (PE); Fengjie Hsien, *M. Y. Fang 24565* (NAS, PE); Fu-hsing-chen, Ch'eng-k'ou ("Tchen-keou-tin") district, *R. P. Farges 171* (E, K, MO, P); Nanchuan Hsien, *K. F. Li 62708, 63422* (PE); Baoxing Hsien, *T. P. Sung 39263* (PE); Chengkuo Hsien, *T. L. Tai 101137* (PE), *104089, 105601* (NAS, PE); Nanchuan Hsien, *J. H. Xiong 92218* (PE); Wushan Hsien, *K. H. Yang 58961* (NAS, PE); Wusi Hsien, *K. H. Yang 59404* (NAS, PE). TAIWAN: Hualien Hsien, Tai-lu-ko ("Ta-gi-li"), *S. Sasaki in 1932* (TAI 081843).

This species is by far the most local of the species of *Circaea*. The collections are from relatively widely scattered areas in central China and from a single



FIGURES 6–7.—6. Distribution of *Circaea glabrescens* (Pamp.) Hand.-Mazz.—7. Distribution of *Circaea mollis* Sieb. & Zucc.

disjunct station in Taiwan. The specimen from Taiwan is part of a mixed collection and is mounted on the same sheet with *C. erubescens*. According to Ching-I Peng (pers. comm.), the site where it was collected in 1924 at Tai-lu-ko ('Tagili') has now been converted into a holiday resort and the plant may have been exterminated. Attempts to relocate *C. glabrescens* in Taiwan should still be made, however.

*Circaea glabrescens* bears some resemblance to *C. cordata* and *C. erubescens*. It resembles *C. erubescens* most closely in the shape and size of the fruit, so much so that it would be difficult to say to which of the two species an isolated fruit belonged. On critical examination, however, it appears that *C. glabrescens* is much more closely related to *C. cordata* than to any of the other species of the genus. Characters shared by *C. glabrescens* and *C. cordata* are: nectary wholly included within the floral tube; relatively short pedicels in flower and fruit; similarity in petal shape; and consistent presence of bracteoles. The long hairs at the apex of the buds in some populations of *C. glabrescens* are identical to the long, spreading hairs of *C. cordata*.

It has been suggested by Raven (1977) that the single collection of *Circaea glabrescens* from Taiwan might be the result of hybridization between *C. eru-*

*bescens* and *C. cordata*. Field and herbarium studies have shown that hybrids of that combination bear no similarity to *C. glabrescens*, and in the field living plants of *C. glabrescens* are very distinct. Raven has examined pollen from the single specimen of *C. glabrescens* from Taiwan and has noted on the sheet "pollen good." Pollen of *C. cordata* × *C. erubescens* produces 15% or less good pollen.

*Circaea glabrescens* has been the source of much confusion and roughly half of the plants attributable to this species have been misidentified. In addition, several collections of other species, or of hybrids, have been called *C. glabrescens*. Oddly enough, *C. erubescens* is the species with which *C. glabrescens* is most often confused, perhaps owing to similar vegetative appearance. The most characteristic feature of *C. glabrescens* is the absence of an exerted nectary, always present in *C. erubescens*. *Circaea erubescens* always has petals longer than wide, obtrullate to obovate in shape, and the apical notch one fifth or less the length of the petal. In *C. glabrescens* the petals are wider than long, oblate to broadly obovate, and the apical notch is ca. one third the length of the petal. The hybrids with which *C. glabrescens* has been confused always have the nectary exerted, at least as a low ring at the mouth of the floral tube. Once these discordant elements are removed, *C. glabrescens* shows a high degree of morphological constancy and can be recognized easily.

### 3. *Circaea mollis* Siebold & Zucc., Abh. Akad. Muench. 4: 134. 1843.—FIG. 8.

*Circaea coreana* H. Lév., in Fedde Repert. Spec. Nov. Regni Veg. 4: 226. 1907. TYPE: Korea, Hoang-kei-to, August 1906, *U. faurie* 654 (BM, lectotype; KYO, isolectotype).

*Circaea coreana* H. Lév. var. *sinensis* H. Lév., in Fedde Repert. Spec. Nov. Regni Veg. 4: 226. 1907. TYPE: China, Guizhou, *J. Esquirol* 647.

*Circaea lutetiana* L. var. *taquetii* H. Lév., in Fedde Repert. Spec. Nov. Regni Veg. 7: 340. 1909. TYPE: South Korea, Cheju-do (Quelpaert Isl.), in forest of Yeng-sil, 1,000 m, 17 August 1908, *E. taquet* 828.

Erect or occasionally decumbent at the base, 2.5–15 dm tall, freely branched, especially above, with numerous axillary branches, rarely simple; forming long rhizomes without tuberous thickenings which give rise to the following year's plants from their tips. Stems pubescent, often very densely so, with soft, short, falcately recurved hairs ca. 0.2 mm long; petioles with soft, short, upwardly curved falcate hairs ca. 0.2 mm long; main veins and leaf margins with hairs as on the petioles, the interveinal areas with soft falcate hairs ca. 0.1 mm long, these occasionally lacking on the lower surface, rarely lacking on the upper; axis of the inflorescence with hairs as on the stem, 0.2–0.3 mm long, or with capitate or clavate-tipped glandular hairs 0.2–0.3 mm long, or with a combination of these or sometimes glabrous; buds, sepals and floral tube with short, ca. 0.1 mm long, soft, capitate or clavate-tipped glandular hairs, sometimes the floral tube glabrous, less frequently the buds and sepals glabrescent or glabrous. Stems green, the nodes darkened, brownish or reddish purple. Leaves horizontally spreading, the longest somewhat drooping at the tips, green, opaque; those at, or slightly above, the middle of the stem the largest, (3–)5.5–13(–16) cm long, 2–5.5 cm wide, becoming gradually reduced in size upward and eventually bractlike and opposite or alternate at the base of the inflorescence; narrowly to broadly lanceolate to narrowly ovate, smoothly tapering to slightly acuminate to the obtuse or subacute tip, narrowly to broadly cuneate, or occasionally rounded at the base, subentire

to denticulate. Petioles (0.7–)1.2–2.5(–4) cm long, sparsely to densely pubescent, with upwardly curved, falcate hairs ca. 0.2 mm long; most commonly with floriferous branches in the axils, occasionally with the lower branches reduced and non-floriferous, very rarely without axillary floriferous branches. Inflorescence glabrous or sparsely to densely pubescent; when pubescent, with falcately recurved hairs as on the stem, 0.2–0.3 mm long, or with capitate or clavate-tipped glandular hairs 0.2–0.3 mm long, or with an admixture of the two; terminal on the main stem and at the tips of the axillary branches, the terminal raceme most commonly branched at the base, rarely simple, the racemes at the tips of the axillary branches usually simple; branches at the base of the terminal raceme opposite or the uppermost alternate, subtended by reduced leaves or leaflike bracts; the terminal raceme, from the uppermost leaves or leaflike bracts, 1.5–4 cm long at initiation of flowering, to ca. 20 cm long at cessation of flowering, the lateral racemes 1–3 cm long at initiation of flowering to ca. 15 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels 1.5–3(–3.3) mm long, perpendicular to the axis of the raceme, without, rarely with, a minute, setaceous bracteole, 0.1–0.3 mm long, at the base; glabrous, or more commonly pubescent with capitate or clavate-tipped glandular hairs, 0.1–0.2 mm long. Fruiting pedicels 2.3–3.2(–4.2) mm long. Buds glabrous or pubescent with short, somewhat crisped, glandular hairs ca. 0.1 mm long or with straight, capitate and clavate-tipped glandular hairs 0.1–0.2 mm long; green, ovate to broadly so to oblong or obovate in outline, smoothly rounded or very short acuminate to the obtuse or minutely mammiform apex; (2.2–)2.5–3.2(–4.2) mm long, (0.9–)1.1–1.4(–1.8) mm thick just prior to anthesis. Ovary (1–)1.2–1.8 mm long, 0.8–1.5 mm thick at anthesis, pyriform to globose, densely covered with soft, translucent, uncinuate hairs. Floral tube 0.5–0.8(–1) mm long, 0.2–0.3 mm thick at the narrowest point, obconic to funnelform, glabrous or occasionally pubescent, with short, capitate and clavate-tipped glandular hairs ca. 0.1 mm long. Sepals 1.6–2.4(–2.9) mm long, 1–1.5 mm wide, abruptly short acuminate to the obtuse or minutely mammiform-tipped apex, glabrous or occasionally pubescent abaxially, with short capitate and clavate-tipped glandular hairs ca. 0.1 mm long; pale green or whitish; divergently spreading or somewhat reflexed in flower. Petals (0.7–)1–1.8 mm long, (1–)1.4–2.6 mm wide, white, broader than long, rarely longer than broad, broadly to very broadly depressed obovate in outline, occasionally short-clawed; the apical notch 0.2–0.5(–0.8) mm long,  $\frac{1}{4}$ – $\frac{1}{2}$  the length of the petal. Stamens normally spreading at anthesis, shorter than or occasionally equal to, rarely longer than, the style; filaments 0.8–1.8(–2.1) mm long; anthers 0.5–0.7 mm long, 0.3–0.6 mm thick. Style straight or slightly drooping, 1.8–2.9(–3.9) mm long, topped by a narrow, transversely oblong or depressed obtriangular, prominently bilobed stigma, 0.3–0.4 mm tall, 0.5–0.8 mm thick. Nectar secreting disc conspicuous and exerted above the floral tube, 0.2–0.4 mm tall, 0.4–0.5 mm thick, cylindrical. Mature fruit 2.6–3.5 mm long, (2–)2.4–3.2 mm thick, very broadly pyriform to globose, rarely narrowly pyriform, truncate to slightly rounded at the apex, ultimately tapering concavely and obliquely to the pedicel; bilocular and 2-seeded, with prominent ribs and deep sulci, densely covered with stiff, translucent, uncinuate hairs, 0.5–0.7(–1) mm long, these commonly restricted to the summit of the ribs, also with short, capitate and clavate-tipped glandular hairs ca. 0.1 mm

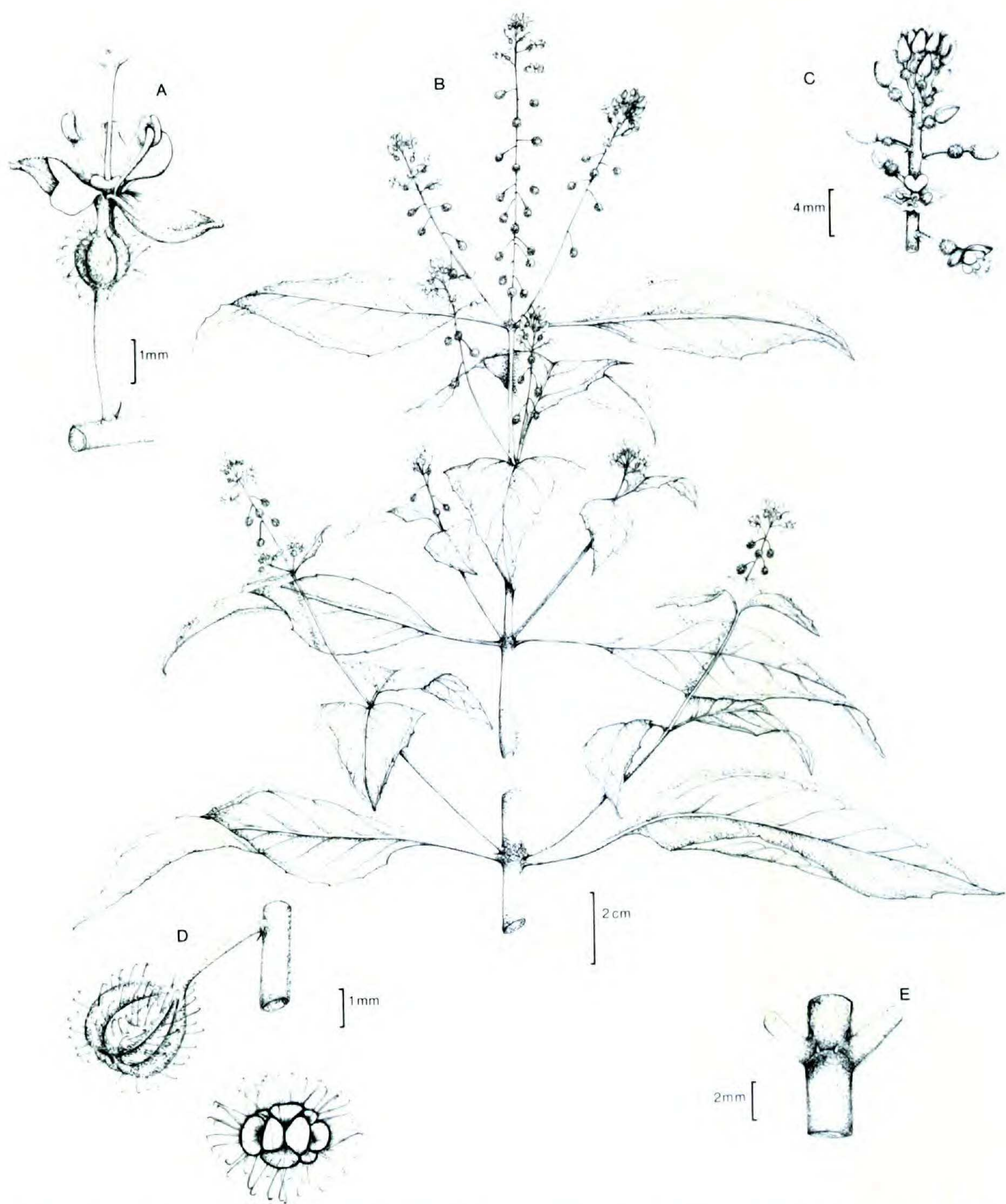


FIGURE 8. *Circaea mollis* Sieb. & Zucc.—A. Flower; note exserted nectary.—B. Mid and upper flowering stem.—C. Inflorescence.—D. Fruit.—E. Upper node of stem. From Boufford & Wood 19553 (KYO, MHA, MO, PE).

long. Fruiting pedicel reflexed, often sharply so, at maturity. Combined length of pedicel and mature fruit, 5–7 mm long. Gametic chromosome number,  $n = 11$ .

TYPE: Japan ("Nipponia"), *P. Siebold* (L, lectotype. P, photograph; L, 2 sheets isoelectotypes).

Distribution (Fig. 7): Cool to warm temperate deciduous forests. Japan, from central Hokkaido southward to southern Kyushu; South Korea, including Cheju-do (Quelpaert Island); locally in northeastern China and southeastern U.S.S.R.,



and then more commonly near the coast from Beijing to south-central China, then westward across southern China to the northern mountainous areas of Vietnam, Cambodia, Laos, Burma, and easternmost Assam, India. Near sea level to ca. 1,700 m. Flowers mid-July to early September, sporadically to mid-September.

Representative specimens examined:

U.S.S.R.

RUSSIAN S.F.S.R. A specimen from Sachalin, Yuzhnosakhalinsk ("Toyohara"), *S. Akiyama* in 1933 (KANA), may be this species. Skvortsov (1979) cites two collections from the Soviet Union, both from the vicinity of Lake Hanka in the extreme southeastern part of the Soviet mainland.

ASIA

BURMA. Hills N of Geawgaw, *G. Forrest* 24829 (E); Bhamo, *A. Huk* in 1892 (K).

CHINA. ANHUI: Jurhua, *Exped. Anhui* 5361 (NAS); Hai-Wei Monastery, *Y. L. Keng* 2641 (NAS); Huo Mt., *Stat. Bot. Est. China* 6755 (NAS); Guangse, *without collector* 2931 (NAS). FUJIAN: Nanjing Hsien, *Amoy Univ. Exped.* 1159 (PE); Shouning Hsien, *R. C. Ching* 2276 (A, E, S, UC, US, W); Jianning Hsien, *Z. Y. Li* 7901 (PE); Liancheng Hsien, *Y. Ling* 3945 (PE); Wuyi Shan, *C. P. Tsien* 400769 (PE); Lianchung Hsien, *D. S. Wang* 1065 (PE). GANSU: Wen Hsien, *Z. Y. Chang* 14620 (PE). GUANGXI: Damiao, *S. C. Chan* 15220, 16871 (NAS), 15379 (NAS, PE); Linyen, Tsinglung Shan, *R. C. Ching* 6879 (A, NAS, NY, S, W); Lungsheng Hsien, *Guangfu Exped.* 1066 (PE); Lingluo, *S. K. Lau* 18700 (A, NAS); Lingyun Hsien, *X. Q. Liu* 28700 (PE); Ziyuan, *X. Q. Wang* 78003 (NAS). GUIZHOU: Kuei-yang, gorges of Yan-pa, *E. Bodinier* 2453 (P); "Kweichow," *M. Cavalerie* 3114 (P); Kweiyang, *T. P. Chien* 30006 (PE); Thong-kai, *J. Esquirol* in 1911 (G); Xingren, *Exped. Guizhou* 8466 (NAS); Kao-p'o, *G. Labarde & E. Bodinier* 2717 (P); Dejiang Hsien, *N Guizhou Exped.* 1747 (NAS); Rongjian, *S Guizhou Exped.* 3072 (NAS); Kaili, *S Guizhou Exped.* 5542 (NAS); Tsingchen, Wha-chou, *S. W. Teng* 90639 (A); Guangcheng, Ma-an-shan, *Y. Tsiang* 8597 (NAS, NY, PE, S, UC, W); Fanchin Shan, *P. C. Tsoong* 3602 (PE). HEBEI: Beijing ("Peking"), *Dr. Bushell* s.n. (NY); "Hopeh," *C. K. Yang* 1627 (NAS). HENAN: Lushi Hsien, *K. C. Liou* 4873 (PE). HUBEI: Shinshan Hsien, *S. S. Chin* 8169 (NAS); Hsing Shan, *Y. Chen* 15072 (UC); Yichang ("I-ch'ang"), *W. Y. Chun & S. S. Chien* 8169 (UC); Lichuan Hsien, *L. Y. Dai* 665 (PE); Nan-t'o, *A. Henry* 4640 (K, TI); "Hupeh," *A. Henry* 5102 (E, G), 6573B (US); Laifeng Hsien, *H. G. Li* 7146 (PE); Xianfeng Hsien, *H. G. Li* 9346 (PE); Shennongjia, *Shennongjia Exped.* 315016 (PE); Chengyang Hsien, *T. P. Wang* 11540 (PE); Ziqui Hsien, *T. P. Wang* 11874 (PE); "W Hupeh," *without collector* 665 (WH); "Hupeh," *without collector* 267 (WH). HUNAN: Dafobin, *E. Dahlström* 253 (S); Ma-ling-tung, Hsin-ming Hsien, *C. S. Fan & Y. Y. Li* 531 (BM, G, GH, L, NAS, P, W); Yongshun Hsien, *Hunan Exped.* 412 (PE); Nanyue, *K. C. Kuan* 188 (PE); Qianyang Hsien, *Z. T. Li* 24, 1434, 2840 (PE); Baojing Xing Hsien, *L. H. Liu* 9711 (PE). JIANGXI: Huang-yan-Ssu, Lu Shan, *H. C. Cheo* 290 (CAS, E, K, NAS, TAI); Shangyou Hsien, *T. L. Chin* 263, 805 (PE); Lu Shan, *R. C. Ching* 10224 (PE), *Y. Chow* 1172 (NAS); Tchong Yun, *P. Courtais* in 1922 (NAS); Oyyuen, *P. Courtais* 31448 (NAS); Lu Shan, *K. C. Kuan* 74355, 74472 (PE); Kien-nan, Tung-lei, Sai-hang-cheung, *S. K. Lau* 4178 (BM, G, GH, S, US); Lungnan Hsien, near Lam-uk, Oo-chi-shan, *S. K. Lau* 4722 (BM, G, S, US); Lushan, *H. Migo* in 1941 (NAS); Chin-chiang, *O. v. Moellendorf* in 1873 (BM); Chiu-ling-shan, Lushan, *A. K. Schindler* 350a (BM); Yungshiu, Ai-ch'eng, Sa-tiu-hong, *Y. Tsiang* 10636 (NAS, NY); Lu Shan, *P. C. Tsoong* 566, 10033 (PE), *M. J. Wang* 923 (NAS); Lichuan Hsien, *M. J. Wang* 2295 (NAS, PE); Nanchang Shi, *X. X. Yang* 10043 (PE); Wang-cheng Kang, *Y. H. Yang* s.n. (PE); Jinggang Shan, *J. S. Yue* 475 (NAS); Wue Hsien, *J. S. Yue* 2024 (NAS); Guenagchang, *J. S. Yue* 2552 (NAS); Anfu, *J. S. Yue* 2957 (NAS); Suichuan, *J. S. Yue* 4031 (NAS). JIANGSU: Shanghai, *E. Faber* 110/87 (K); I-hsing-wu-fu, *K. Ling* 12385 (UC); Yun-tai Shan, Chiu-lung chiao, *F. H. Liu* s.n. (PE); Liyang, *F. S. Liu et al.* 2641 (NAS); Yuntai Shan, *F. X. Liu* 10727, 10918 (NAS, PE); Yixing, *W. Z. Fang* 226, 7964 (NAS). JILIN: Emu Hsien, *H. W. Kung* 2000 (PE); Dunhua Hsien, *T. N. Liou* 3514 (NAS); Tongmeling, *Y. Yabe* in 1918 (NAS). GUANGDONG: no further data, *S. W. Teng* 90639 (NAS). LIAONING: Fusong Hsien, *Y. L. Chang & P. Y. Fu* 750 (NAS); Fenghuang, *Y. Yabe* in 1909 (NAS); Wulong, *Y. Yabe* in 1909 (NAS); Caohekou, *Y. Yabe* in 1910 (NAS); Qian Shan, *Y. Yabe* in 1918 (NAS). SHAANXI: Yang Hsien, *K. T. Fr* 5208 (PE); Liuba Hsien, *K. T. Fr* 6209 (PE); Yang Hsien, Hua-yang, *S. C. Fu* in 1958 (PE); Shang Hsien, *T. P. Wang* 16030 (PE). SHANDONG: Lao Shan, Tailingkio, *C. Y. Chiao* 2906 (DS, E, GH, K, MT, NAS, NY, PE, S, TAI, UC); Meng Shan, *Exped. Wil. Pl. Shandong* 6084 (NAS); Tsinghai, *Zimmermann* 428 (G, GH, P). SICHUAN: Feng Hsien, *T. R. Chang* 25920 (NAS, PE); Emei Shan, *S. Y. Chen et al.* 4265 (NAS); Miy, *S. Y. Chen et al.* 10788 (NAS); Emei Shan, *C. Y. Chiao & C. S. Fan* 343 (A), *C. L. Chow* 6891 (PE), *H. C. Chow* 8280 (A); Feng Hsien, *H. F.*

*Chow* 26849 (PE); Fangure, *H. F. Chow* 26894 (NAS); Wushan, *H. F. Chow* 109996 (NAS); Nanxi Hsien, *T. L. Dai* 10140 (PE); Chenkou Hsien, *T. L. Dai* 103177 (PE); Chien-feng-shan ("Tchen-fong-chan"), *P. Delavay* 5054 (DS, G, MO, P, US), 5179 (P), *F. Ducloux* 2155 (P); Liangshan, *Exped. Pl. Med. Sichuan* 28168 (NAS); Emei Shan, *W. P. Fang* 32554 (PE); Wu-shan, *A. Henry* 7215 (K, NY); Emei Shan, *C. H. Hsiung et al.* 32172 (NAS, PE); Nanchuan, *K. F. Lee* 63460 (NAS); Nanchuan Hsien, *K. F. Li* 63569 (PE), 64859 (NAS, PE); Emei Shan, *T. N. Liou* 853 (PE), *T. C. Peng* 187 (A); Kiating, *L. Y. Tai* 1382 (A); Yaan Hsien, *T. P. Wang* 8583 (PE); Guan Hsien, *C. L. Wu* 33760 (PE); Nanchuan Hsien, *J. H. Xiong* 92879 (PE); Eshan Hsien, *K. H. Yang* 56963 (PE); Wuxi Hsien, *K. H. Yang* 65142 (NAS, PE); Emei Shan, Fu-hu-shih, *K. H. Yang in 1957* (PE); Emei Shan, *K. N. Yin* 191 (A). YUNNAN: Yunnan-sen, *J. Cavalerie* 212 (E); Fuming, *P. Y. Chiou* 596397 (KUN); Ta-li-fu, E slope of the Tsau-shan range, *G. Forrest* 1054 (E, K); Ming-kuang-ho valley, *G. Forrest* 8286 (E); Chiu-kuei-ting? (Geugyueh), *G. Forrest* 8736 (E); Yunnanfu-Dali Road, Gwangdung, *H. Handel-Mazzetti* 4893 (W); Kua-yin Hsien, Man-mai, S of Red R., *A. Henry* 9733 (E, K, LE, MO, US); Meitzu, *A. Henry* 9733A (K), 9733B (E, K, MO, NY); Takwan, *NE Yunnan Exped.* 555 (KUN); Luchun, *D. D. Tao* 981 (PE); Pingbian Hsien, *H. T. Tsai* 61191 (A, NAS, PE), 61253 (A, PE), 61352 (NAS, PE), 61483 (A, NAS, PE), 61737 (A, NAS, PE); Ta-p'ing-ch'ang, Chengkang, Snow Range, *T. T. Yü* 17237 (A, E); Mien-ning, Taugeh, *T. T. Yü* 18092 (A, E). ZHEJIANG: Lishui Hsien, *S. Y. Chang* 6693 (PE); Lungquan Hsien, *S. Y. Chang* 8768 (PE); Tiantai, *Exped. Nat. Pl. Zhejiang* 1380 (NAS); Hsien-tienmu-shan, *Exped. Pl. Res. Zhejiang* 29048 (NAS); Ning-po-shan, *E. Faber in 1888* (LE, P, S); Changhua, *Y. Y. Ho* 26334 (NAS); Tianmu Shan, *W. Y. Hsia* 239 (PE); Tiantai Shan, *Y. L. Keng* 997 (PE, UC); Hangzhou, *K. Kimura s.n.* (KYO); Tianmu Shan, *T. N. Liou* 6958 (PE); Lishui Hsien, *Lishui Forest School* 6103 (PE); Hsien-tienmu-shan, *H. Migo in 1935* (NAS, TI); Longquan, *R. H. Shan* 5757 (NAS); Mogan Shan, *C. P. Tsien* 61155 (PE); Longquan, *D. S. Tso* 22091 (NAS); Lung-ch'ien, *C. Z. Yu in 1958* (NAS).

INDIA. ASSAM: Manipur, Karong, *T. R. Chand* 3792 (DS, MICH); Naga Hills, Jotsoma, *N. Bor* 6239 (K); Naga Hills, Kegwina, *C. B. Clarke* 41176D (BM, K); Manipur, Ukhrul, *F. Kingdon-Ward* 17971 (BM, NY); Naga Hills, Takubama, *W. N. Koelz* 25807 (MICH).

JAPAN. HOKKAIDO: around Hakodate, *Albrecht in 1861* (LE); Ishikari, Sapporo, *S. Arimoto in 1893* (GH); Hakodate, the Lakes, *J. Bisset* 2839 (BM), 3170 (E); Ishikari, Sapporo, Mt. Maru-yama, *D. E. Boufford & E. W. Wood* 19632 (MO); Iburi, Tomakomai Experimental Forest of Hokkaido Univ., *D. E. Boufford & E. W. Wood* 19657 (BM, CAS, CM, DS, E, G, GH, K, KYO, LD, LE, MHA, MICH, MO, NCU, NY, P); Hidaka, Shizunai-cho, 14 km ENE of Shizunai, *D. E. Boufford & E. W. Wood* 19673 (KYO, MHA, MO); Kushiro, NW edge of Lake Toro-ko, *D. E. Boufford & E. W. Wood* 19744 (CM, G, K, KYO, MHA, MO, NCU, PE); Ishikari, Sapporo, Mt. Teine-yama, *D. E. Boufford & E. W. Wood* 19858 (CM, MHA, MO); Horobetsu, *U. Faurie* 2630 (DS, G, KYO, P); around Junsainuma, *U. Faurie* 6307 (KYO, W); in the forests of Nayoro, *U. Faurie* 6308 (BM, KYO, W); near Mororan, *U. Faurie* 6309 (BM, KYO); Mori, *U. Faurie* 6310 (BM); Ishikari, Sorachi-gun, Manju, *F. C. Greatrex in 1915* (SAP); Hakodate, *F. C. Greatrex* 266 (SAP); Tokachi, Tokachi-gun, Urahoro, *K. Hori in 1896* (SAP); Oshima, Kumai-shi, *D. Hoshi in 1944* (SAP); Ishikari, Barato, *K. Ito in 1962* (SAP); Kazusa, *Z. Iwamoto in 1883* (SAP); Iburi, Shizukari, *T. Kawakami in 1892* (SAP); Oshima, Mt. Fuku-yama, *T. Kawakami in 1892* (SAP); Iburi, Muroran, *S. Kitamura in 1935* (KYO); Hakodate, *C. Maximowicz in 1861* (GH, K, L, NY); Ishikari, Sapporo, *K. Miyabe in 1882* (NY); Ishikari, Barato, *K. Miyabe in 1884* (SAP); Oshima, Fukuyama, *K. Miyabe & Y. Tokubuchi in 1890* (TI); Oshima, Ishizaki, *K. Miyabe in 1890* (SAP); Iburi, Rebunge-toge, *K. Miyabe in 1890* (SAP); Ishikari, Otoibokke, Sorachi, *K. Miyabe in 1891* (SAP); Iburi, Usu, *K. Miyabe & K. Hino in 1931* (SAP); Oshima, Fukushima, *K. Munakata in 1960* (MASS, MHA, MO); Abashiri, Memambetsu, *T. Nakano in 1955* (SAP); Kawakami-gun, *S. Okamoto in 1943* (KYO); Kitami, Ufutsu, *S. Okamoto in 1952* (KYO); Tokachi, Kami-ashi-yori, *S. Okamoto in 1955* (KYO); Tokachi, Shibetsu, Mt. Yoshit-sune, *S. Okamoto in 1959* (KYO); Kushiro, Lake Kusharo, *S. Okamoto* 1072 (KYO); Hidaka, Saru-gun, Tomikawa, *Y. Takahashi in 1963* (SAP); Shiribeshi, Zenibako, *Tekee et al. in 1931* (SAP); Kushiro, Lake Kutcharo, *M. Tatewaki in 1933* (SAP); Oshima, Fuku-yama, *Y. Tokubuchi in 1888* (SAP); Hakodate, *Y. Tokubuchi in 1888* (SAP, TI); Hidaka, Horoizumi, *Y. Tokubuchi in 1892* (MO, SAP); Chitose-gun, Aosari-toge, *Y. Tokubuchi in 1893* (GH, SAP); Oshima, Kishu, *Y. Tsukamoto in 1940* (KYO); Kushiro, Toro, *A. Umezawa in 1956* (SAP); Shiribeshi, Yoichi, *I. Yamamoto* 4269 (KYO); Shiribeshi, Oichi, *I. Yamamoto* 4978 (KYO); Tokachi, Ikeda, *H. Yokoyama in 1936* (TI), *H. Yokoyama & H. Hara* 3248 (SAP); Tokachi, Ikeda-cho, Suigen-shi, *H. Yokoyama* 4252 (SAP). HONSHU: AICHI PREFECTURE: Miwa-mura, *G. Murata* 6597 (KYO); Horaiji Mts., *M. Takeuchi in 1945* (TI). AKITA PREFECTURE: Tohi-shima Island, Akumi-gun, *G. Koidzumi in 1927* (KYO); Oga Peninsula, Monzen, *R. Mochizuki* 0819 (KANA); Mt. Moriyoshi-yama, Naka-mura to the summit, *H. Ohashi* 4855 (TI); Nibetsu, near Seismic Observatory of Tohoku Univ., *K. Sohma* 1575 (MAK); Akita city, Tegata, *S. Tanaka in 1960* (KANA); Yamamoto-gun, Hi-yama, *without collector in 1925* (MAK 117754). AOMORI PREFECTURE: Aomori city, *U. Faurie* 7 (KYO); vicinity of Aomori, *U. Faurie* 955

(P); Aomori, *U. Faurie* 5095 (BM, G, KYO); Higashitsurugu-gun, Miyumaya-cho, Mt. Yakataishidake, *N. Fukuoka* 6851 (KYO); Imabetsu, Okawahira, *K. Hosoi in 1949* (KANA); Minamitsugaru-gun, Owani, Mt. Nijima, *K. Hosoi in 1950* (KANA); Tsugaru Peninsula, Higashitsugaru-gun, from Sanyoshi to Katsura-zawa along Sanyoshi R., *H. Koyama* 1584 (KYO, TNS); Shimokita Peninsula, Shikkari, Kukito-no-misaki, *H. Ohashi* 4554 (TUS); Minamitsugaru-gun, Miyama-mura, Misukawa, *S. Okamoto in 1963* (KYO); Yuno-shima, *Y. Takeuchi in 1960* (TUS); Shimokita Peninsula, Bushidomari, *K. Yoshioka & T. Kanebo in 1964* (TUS); Shimokita Peninsula, Sarugamori, *K. Yoshioka & K. Sugawara in 1964* (TUS). CHIBA PREFECTURE: Ichikawa, *K. Hisauchi* 1637 (L, TI); Umbo, Mt. Kiosumi, *K. Miura in 1910* (SAP). FUKUI PREFECTURE: Obana city, *T. Izaki in 1910* (MAK); Fukui city, Mt. Asua, *H. Kimura et al. in 1965* (KANA); Eiheiji, *S. Kitamura in 1961* (KYO); Tsuruga city, *S. Kitamura & G. Murata* 2088 (KYO); Yoshida-gun, Eihaiji-Urayama, Mt. Daibutsuji-yama, *H. Koyama* 1086 (KYO, MAK, SHIN, TNS); Nyu-gun, Iao-mura, Ogawa, *M. Maeda* 535 (KANA); Nyu-gun, Mt. Oshi-san, *G. Masamune* 5232 (KANA, MAK); Imatachi-gun, Imatachi-cho, Nakatsuyama, *S. Mizukami in 1966* (KANA); Tsuruga city, Ikegawachi, *S. Tanaka in 1964* (KANA); Nanjo-gun, Kawano-mura, Imaizumi, *S. Watanabe* 28301 (KANA); Ichijo-taki, *T. Yamamura in 1937* (KANA). FUKUSHIMA PREFECTURE: Sukagawa-mura, *R. Endo in 1912* (TUS); Yama-gun, Bandai-mura, Mt. Umatake-san, *M. Furuse in 1957* (A, NA, S). GIFU PREFECTURE: Mugi-gun, Itadori-mura, from Shimaguchi to Shiraki Pass, *N. Fukuoka & K. Yamashita* 35 (KYO), 48 (KANA); Mugi-gun, Itadori-mura, vicinity of Kadode, *N. Fukuoka & K. Yamashita* 231 (KANA, KYO); Mt. Yoro, *T. Ito in 1890* (TNS); Mt. Jikkyoku-toge in Nakasendo, *T. Ito in 1891* (TNS); Oono-gun, Asahi-mura, Kurumijima, *G. Murata et al.* 418 (KYO); Gunjo-gun, Yawata-cho, *without collector in 1904* (MAK 117773). GUNMA PREFECTURE: Usui-gun, Hakun-zan in Mt. Myogi-san, *G. Murata* 27485 (KYO); Usui-gun, Gokan-mura, Mt. Chogenji, *Nakajima in 1933* (KYO); Hanashiki-onsen, *J. Ohwi in 1929* (KYO). HYOGO PREFECTURE: Kinoshiki-gun, Mikata-mura, Mt. Sofuka-dake, *Y. Araki in 1932* (KYO); Yabu-gun, Sekinomiya-cho, NE foot of Mt. Hyonosen, *D. E. Boufford & E. W. Wood* 19553 (BM, CAS, CM, E, G, GH, K, KYO, MHA, MO, NCU, NY, P, PE, S, SHIN, UC); Yabu-gun, Oya-cho, Ikada, *D. E. Boufford et al.* 19577 (K, KYO, MO); Mikata-gun, Onsen-cho, Kiri-taki waterfall, *D. E. Boufford et al.* 19593 (BM, CM, GH, KYO, LE, MHA, MO, NY, P, UC), *G. Murata* 20679 (KYO); Shiso-gun, Haga-cho, Tokura, *D. E. Boufford et al.* 19585 (CM, KYO, MHA, MO); Nunobiki, *T. Fujimoto* 6 (KANA); Mikata-gun, Mt. Suga-no-sen, *N. Fukuoka & Y. Inamasu* 722 (KANA, KYO); Kanzaki-gun, Ichikawa-cho, *I. Hashimoto in 1902* (MAK); Shikama-gun, Mt. Seppiko, *M. Hiroe* 6271 (KYO); Kanzaki-gun, Okawachi-cho, Kawakami, *M. Hiroe* 17395 (KYO, UC); Hikami-gun, Hikami-mura, Iso, *S. Hosomi in 1935* (KYO); Mikata-gun, Mikata-mura, Koshido-dani, *S. Hosomi* 9902 (KYO); Mt. Roko, *S. Kuriyama in 1928* (MAK); Miki-shi, Hosokawa-cho, *G. Murata & H. Nishimura* 297 (KYO); Hikami-gun, Hikami-cho, Kora, *G. Murata* 19954, 19965 (KYO); Shiso-gun, Haga-cho, Tokura, *G. Murata* 20355 (KYO); Sayo-gun, Nanko-cho, Mt. Hunakoshi-yama, *G. Murata* 33779 (KYO, MO); Shiso-gun, Haga-cho, Onzui, *M. Tagawa & K. Iwatsuki* 5206 (KYO); Shiso-gun, Chikusa-mura, Nabegatani Government Forest, *M. Tagawa* 6367 (KYO). IBARAGI PREFECTURE: Kamiura city, Kidayo-mura, *without collector in 1901* (MAK 117792); Tsuchiura city, *without collector in 1905* (MAK 117757). ISHIKAWA PREFECTURE: Kanazawa city, Okushinbo, *S. Enu in 1967* (KANA); Kanazawa city, Okua-cho, *E. Etchu in 1967* (KANA); Mt. Ioo, Nishio-daira, Kunimi Pass, *N. Fukuoka* 4327 (KANA); Suzu-gun, Ogi, *Furuike in 1958* (KANA); Suzu-gun, Doronoki, *Furuike in 1958* (KANA); Mt. Udatsu, *R. Hara in 1957* (KANA); Mt. Hakusan, *T. Ichimura* 1441 (KANA); Kanazawa city, Noda-cho, *R. Ikeda in 1953* (KANA); Komatsu city, Osugidani, *K. Kaburagi in 1963* (KANA); Kashima-gun, Kashima-cho, *R. Kaga in 1965* (KANA); Hoshi-gun, Munzen-cho, Minazuki, *T. Kikuchi* 676 (KANA); Kanazawa city, Mt. Utatsu-yama, *G. Masamune in 1957* (KANA, KYO); near Kanazawa, Kurokabe, *G. Masamune* 5176 (KANA); Kasime-gun, Sekido-san, *G. Masamune* 5627 (KANA); Hugeshi-gun, between Urakami & Minazuki, *G. Masamune* 5823 (KANA); Hugeshi-gun, between Tsurugiri & Takatsume-yama, *G. Masamune* 12473 (KANA); Hodai-gun, Mt. Isurugi, *G. Masamune* 5627 (KANA); Mt. Kyoga-take, Oono city, *G. Murata & T. Shimizu* 398 (KYO); Ishikawa-gun, *H. Nakagawa* 0588 (KANA); Hoshi-gun, Yanagida-mura, *S. Noriichi in 1969* (KANA); Hoshi-gun, Mitsui, Bantan-san, *N. Satomi in 1963* (KAG); Ishikawa-gun, Mt. Gasseki, *T. Shimozawa in 1953* (KANA); Kanazawa city, Kanazawa Castle, *S. Tanaka in 1960* (KANA); Kanazawa city, Mt. Urotatsu, *S. Tanaka in 1962* (KYO); Mt. Udatsu, *S. Tanaka in 1962* (KANA); Ishikawa-gun, Tsurugicho, *I. Umeda in 1954* (KANA); Mt. Hodatsu, *S. Yamamori* 3805 (KANA); Botanical Garden, Univ. of Kanazawa, *S. Yoshitake & S. Kaneda in 1966* (TI). IWATE PREFECTURE: Morioka city, Asagishi, *M. Kikuchi in 1967* (TNS); Tensho-shi, *T. Naruse in 1965* (KANA); Hosoura, *S. Suzuki in 1952* (UC, WTU); Takada city, Otomo, *G. Toriba in 1901* (MAK). KANAGAWA PREFECTURE: Jinmuji, *Y. Asai in 1952* (TI); Yokohama, *J. Bisset* 629 (E, K), 630 (BM), *F. Dickins* 2031 (PH), *C. Maximowicz in 1862* (LE); Enoshima, *S. Momose* 286 (TI); Hakone, Ashino-ko, *S. Okamoto in 1966* (SHIN); Hakone, *P. Savatier* 412 (P); Hakone, Sengoku-bara, *S. Suzuki in 1951* (UC, WTU). KYOTO PREFECTURE: Kumano-gun, Kawakami-mura, Mt. Kyoruji-yama, *Y. Araki* 9643 (KYO); Kasa-gun, Kamogami-mura, Mt. Oe-yama, *Y. Araki* 9647 (KYO, TNS); Kyoto city, Sakyo-ku, *D. E. Boufford* 19604 (MO);

Kyoto city, WNW side of Mt. Daimonji-yama, *D. E. Boufford & S. Mitsuta 19959* (CM, KYO, MO); Takeno-gun, Yasaka-cho, Noma, Sukawa, *N. Fujita & I. Kojima 99* (KYO); N of Kyoto, Kyu-hanasekaido, *M. Hiroe 15041* (UC); Kitakuwada-gun, Miyama-cho, Choji-dani in Ashiu Experimental Forest of Kyoto Univ., *K. Iwatsuki 5521* (KYO); Mt. Oe-yama, *N. Kinoshita in 1906* (MAK); between Takai & Kiyotaki, *S. Kitamura in 1936* (KYO); Mt. Kibune, *S. Matsuda in 1892* (KYO); Daihi-zan, N of Kyoto, *G. Murata 9895* (KYO); Ashiu Experimental Forest of Kyoto Univ., *S. Okamoto in 1936* (KYO), *S. Okamoto in 1951* (SHIN); Wachi, *M. Ota in 1966* (KANA); Kyoto city, Mt. Hiei, *M. tagawa 284* (KYO); Hanase-toge, N of Kyoto, *M. Tagawa 4008* (KYO, TNS). MIE PREFECTURE: Kameyama city, from Sakamoto to the summit of Mt. Nonobori, *N. Fukuoka 5105* (KYO); Inabegun, Ishigure-mura, Mt. Ryuga-dake, *N. Fukuoka 5978* (KYO); Ichishi-gun, Misugi-mura, near Mt. Miune, *N. Fukuoka 6083* (KANA, KYO); Isshi-gun, Taro-mura, Mt. Kuro-san, *H. Kanai in 1962* (TI); Ise city, Mt. Asama, *H. Kanai 6816* (H, TI); Experimental Forest of Mie Univ., *S. Kitamura in 1963* (KYO); Watarai-gun, Shimadzu-mura, *Kowana 75* (MAK); Ichishi-gun, Misugi-mura, Hirakura, *G. Murata 18393, 18409* (KYO); Yuno-yama-onsen, *G. Nakai 4617* (KYO); Naga-gun, Kozumura, *G. Nakai 4764* (KYO); Kamiji-yama, Ise Shrine, *A. Nitta 11357* (KYO); Azan-gun, Ueno-cho, *Sadaishi 6932* (MAK); Ise Shrine, *Y. Sakamoto in 1938* (KANA). MIYAGI PREFECTURE: Miyagi, *F. & C. Baker in 1914* (CAS); Kinkazan Island, Ojika-gun, *M. Kikuchi in 1967* (TNS); Natori-gun, Akiu-cho, SE foot of Mt. Ohazuma, *H. Koyama 4129* (KYO); Miyato-jima, *T. Kyogoku in 1956* (TUS); Ishimaki-cho, *Odashima in 1906* (MAK); Sendai, Aobayama, *K. Sohma 1574* (MAK, MO, TUS); Mt. Kurikoma, *S. Sugaya et al. in 1952* (TUS); Matsushima-cho, Mt. Tomi-yama, *E. W. Wood & D. E. Boufford 3966* (KYO, MO). NAGANO PREFECTURE: Chiisata-gun, Shioda-cho, Bessho-onsen, *N. Kitagawa 5385* (KYO); Shimonakai-gun, vicinity of Jigoku-dani, *M. Minemura 837* (MAK); Ukawairi, Susawatari to Higashi-sawaguchi, *S. Momose in 1934* (TI); Kamiminouchi-gun, *M. Murasawa in 1906* (MAK); Iiyama city, *T. Saito in 1906* (MAK); Koshoku-shi, Oike Pond, S of Obasute, *T. Shimizu 17035* (SHIN); Hanishina-gun, Mt. Kyodai, *T. Shimizu 17374* (SHIN); Mt. Togakushi, *H. Tamura in 1923* (KAG); Kitasaku-gun, Bogetsu-cho, *without collector in 1925* (MAK 117768). NARA PREFECTURE: Mt. Katsuragi, *H. Ohashi et al. 632* (KYO, TI); Mt. Muro, *M. Tagawa 3494* (KYO). NIIGATA PREFECTURE: vicinity of Kashiwazaki city, *K. Abe in 1905* (MAK); Mt. Myojyo, *T. Ajima 4316* (KANA); Sado Island, *U. Faurie 1337* (KYO); Nakakambara-gun, Kanezu-mura, *S. Ito in 1904* (SAP); Kitaonuma-gun, Yunotani-mura, between Oyu & Kamanoyu, *S. Kitamura & G. Murata 2705, 2723* (KYO); Awa-shima Island, *K. Mori in 1956* (KANA); Sado Island, Mt. Todara-mine, *G. Murata 6457* (KYO); Nishi-kubiki-gun, Mt. Myojo, *T. Shimizu 12952* (S, SHIN); Kirita, Arakawa-machi, *S. Togasi 1797* (A, BM, COLO, DAO, E, G, H, K, KAG, KANA, KYO, MO, MTJB, NA, NTUF, NY, P, S, SAP, TI, TNS, TUS, UPS, US, WTU); Shiro-yama, E foot, *without collector & date* (MAK 117790). OKAYAMA PREFECTURE: Shin-zan, *S. Arimoto in 1903* (SAP). OSAKA PREFECTURE: Mino city, *S. Matsuda in 1896* (KYO); Mino city, from Masano-choya to Katsuo-ji, *A. Nitta 10794* (KYO); Kitakawachi-gun, Shijonawate-jinja, *K. Seto 6974* (OSA). SAITAMA PREFECTURE: Noda city, *F. Atsusawa in 1910* (MAK); Minamisaitama-gun, Sakurai-mura, *R. Ito 717* (MAK); ca. 2 km S of Urawa, *T. Koyama 309* (DAO); Segasaki in Urawa, *T. Koyama 5221* (DAO). SHIGA PREFECTURE: Higashiasai-gun, Asai-machi, vicinity of Takayama, S foot of Mt. Kanakuso, *N. Fukuoka 5204* (KYO); Inukami-gun, Taga-cho, Hozuki, Mt. Nabejiri-yama, *H. Koyama 5477* (KYO, MO), *5481* (KYO); Katata-cho, Umenoki to Kowai, *G. Murata 17352* (KYO); Mt. Ibuki-yama, Ueno to the top, *T. Shimizu 0654* (KYO). SHIMANE PREFECTURE: Kanoashi-gun, Kakino-cho, Suzuno-otani-yama, *I. Miyamoto 2861* (MAK); Hirata city, Saka-cho, *I. Miyamoto 62084* (MAK); Hirata-cho, Gakuenji, *G. Murata 11646* (KYO); Oki Island, Oki-gun, *without collector in 1889* (MAK 117779). SHIZUOKA PREFECTURE: Miyake-jima Island, *N. Hayashi 239* (KYO); Fuji-gun, Shiraito-mura, Inokashira, *H. Kanai in 1962* (TI); Minamiizu-cho, Nanigatsu, *H. Naguchi 4645* (KAG); Izu, Amagi-toge, *M. Tohyama in 1953* (SAP). TOCHIGI PREFECTURE: Nikko-kaido, Ninami, *K. Miyabe in 1882* (SAP). TOKYO PREFECTURE: Hachijo Island, Mt. Hachijo-fuji, *M. Hori in 1964* (OSA); Setagaya-ku, Todoroki, *S. Kobayashi 751* (CAS); Nakano-ku, Arai, *T. Makino in 1896* (MAK); Dokanyama, *T. Makino in 1900* (MAK, S); Shinbasu-no-ike Pond, *S. Matsuda in 1890* (KYO); Tokyo, *J. Matsumura in 1878* (US); Musashi, Koshigaya, *J. Ohwi 333* (A, B, BM, DAO, E, G, H, KAG, KANA, KYO, L, MICH, MO, MT, MTJB, NA, NTUF, NY, S, TI, TNS, TUS, UC, UPS, US, W); Komae, *S. Suzuki in 1949* (K, UC); Nippara, *S. Suzuki 364* (A); Nakano near Tokyo, *H. Takeda 253* (K); Tokyo, *T. Terasaki in 1908* (K); Nakano near Tokyo, *T. Uno 253* (BM); Narima-ku, Shijakui, *without collector in 1939* (MAK 117761); Miyake-mura, Miyake Island, *without collector in 1937* (MAK 117771). TOTTORI PREFECTURE: Tottori city, Matsugami, *A. Tanaka 20724* (KYO). TOYAMA PREFECTURE: Fuko-cho, Yamamoto, *H. Furuike in 1955* (KANA); Mt. Tateyama, *T. Ichimura in 1890* (KANA); Iguchi-mura, Maruyama, *Ishioka in 1973* (KANA); Shimoshinkawa-gun, Ogawa-onsen, *H. Kanebo in 1962* (KANA); Nakanikawa-gun, Kamiichi-mura, Mt. Daikamine, *N. Kurosaki 2123* (SHIN); Nakanigawa-gun, Kamiichi-mura, Nagara Pond, *N. Kurosaki 2191* (KYO); Nakashinkawa-gun, Uechi-cho, Oiwa, *N. Kurosaki 2262* (KANA); Kurobe city, *M. Uishiro in 1905* (MAK); Io-zen, *K. Yoda 278* (KANA). WAKAYAMA PREFECTURE: Higashimuro-gun, Shinokawa-dani, *T. Kodama in 1951* (OSA); Minamimuro-gun,

Kuki-mura, *G. Murata* 9973 (KYO); Awo-ga-shima, *T. Tuyama* in 1933 (TI); Nishimura-gun, Daito-mura, Tsuruji-jinja, *T. Yamamoto* 374 (KYO); Mt. Koya-san, *without collector* in 1902 (MAK 117777). YAMAGATA PREFECTURE: Higashine city, Makino, *D. E. Boufford & E. W. Wood* 19877 (CM, KYO, MHA, MO, PE); near Koshigoe, *F. Greatrex* in 1935 (K); Kitamura-yama-gun, Komatsu-sawa, *S. Inoue* in 1914 (MAK); Tsuruoka city, Mt. Kimpo-yama, *K. Mori* in 1897 (MAK); Tobi-shima Island, *K. Mori* 17043 (S); between Yamadera & Futakuchi Pass, *H. Ohashi* in 1960 (TUS); from Fukuura to Mt. Chokai, *H. Ohashi* 8682 (TI); Akumi-gun, Fukura-mura, Mega, *H. Ohashi* 10610 (TI); Sakata city, *I. Sato* in 1912 (MAK); near Atsumi village, *E. Walker* 7347 (US). YAMAGUCHI PREFECTURE: W of Hiroshima city, base of Mt. Shiro-yama, Senjo-kubara, *L. Charette* 1381 (COLO, MO, UC, US, VT), 1862 (MO, NA, S, UC, US, VT); Kuga-gun, Hirose-deai, *H. Migo* in 1952 (KANA); Tsunogun, Shikano, *H. Migo* in 1953 (KANA); Kuga-gun, Takamori, *H. Migo* in 1954 (KANA); Iwai-shima Island, *H. Migo* in 1956 (KANA); Kuga-gun, Mikawa, Miyano-kushi, *H. Mitsue* in 1952 (KYO); Kinkei-no-taki, *T. Nakai & M. Maruyama* in 1949 (TNS); Namera-yama, Higure-zawa, *T. Nakai & N. Maruyama* in 1949 (TNS); Abu-gun, Tokusa-mura, *H. Ohaba s.n.* (KYO); Tokuyama city, Nagaho, Ryumonji, *K. Oka* 32113 (KYO); Iwakuni city, Shiro-yama, *M. Tagawa* 2494 (KYO); Chofu-mura, *without collector*, 26 July (KAG). YAMANASHI PREFECTURE: Nishiyatsushiro-gun, *H. Kanai* in 1957 (TI); Lake Yamanaka, *T. Makino* in 1936 (MAK); Kaminohara-cho, Gunnai, *S. Okamoto* in 1935 (KYO); Kita-tsuru-gun, Kamina-hara-mura, Tanagashira, *S. Okamoto* in 1935 (KYO); Otsuki city, Mt. Ogi-yama, *S. Okamoto* in 1935 (KYO). KYUSHU: FUKUOKA PREFECTURE: Kasuya-gun, Sasakuri-mura, Mt. Wakasugi, *K. Ishikawa* 200158 (LD, NA, NTUF); Kaho-gun, Kaho-machi, Mt. Kosho-san, *S. Imae* 8462 (KANA); Asakura-gun, Hoshujama-mura, *K. Nagayoshi* in 1961 (KAG); Tagawa-gun, Kawara-machi, Mt. Kawara-dake, *T. Shimizu* 0276 (KYO). KAGOSHIMA PREFECTURE: near Fukiage, *S. Hatusima* 20373 (KAG); between Hanaze & Hetsuke Pass, *S. Hatusima* 20429 (KAG); Mt. Shiba, *S. Hatusima* 21041 (KAG); Mt. Takakuma, *S. Hatusima* 21165 (KAG); Mt. Takakuma Experimental Forest, *Kawagoe* 5065 (KAG); from Kushira to Uchi-no-ura, *T. Naito* in 1926 (KAG); Mt. Takakuma Experimental Forest, *T. Naito* in 1926 (KAG); Koshiki-jima Island, *S. Sako* 1488 (KAG); Kagoshima, *without further data* (TI). KUMAMOTO PREFECTURE: Ago-gun, Kukino-mura, *K. Fukunaga* 5376 (KAG); Aso, Mt. Kitamuki-yama, *S. Imae* 10510 (KANA); Hottaku-gun, Mt. Kimpo-zan, *H. Kamizuma* in 1906 (MAK); Kami-mashiki-gun, Chuo-mura, *Nishiyama & Y. Shimada* 12681 (KYO); Gokanoshō, Momiki, *S. Sako* 954 (KAG), 1117 (KAG, KANA); Gokanoshō, Kureko, *S. Sako* 1304 (KAG); Yatake, Hitoyoshi city, *S. Sako* 6576 (KAG); Kuma-gun, Itsugi-mura, from Motoi-dani to Hotokeishi, *T. Shimizu* 4757 (KYO); Kuma-gun, Itsugi-mura, W of Itagi, from Toji to Tenguiwa, *T. Shimizu* 5078 (KYO); Yatsushiro-gun, Toyo-cho, Akai-yama, *Y. Simada* 10199 (KYO); Kumamoto city, Ikedai-mura, *without collector* in 1905 (MAK 117787). NAGASAKI PREFECTURE: Fukue city, Goto Islands, *S. Hatusima* 16798 (KAG); Tsushima Island, Shinoagata-gun, Mizushima-cho, NW foot of Mt. Matsu-yama, *H. Koyama* 2761 (KYO, TNS); Tsushima Island, Shimoagata-gun, N foot of Mt. Tatera, *H. Koyama* 3020 (KYO, TNS); Nagasaki, *C. Maximowicz* in 1863 (BM, LE, W), *R. Oldham* 278 (BM, G, K, L, NY, P, S, W); Tsushima Island, *Y. Yabe* 6921 (MAK); Tsushima Island, Iwahara, Aga-toichi-buchi, *Y. Yabe* 6925 (MAK); Sasebo city, Hiu-mura, *without collector* in 1904 (MAK 117788). SHIKOKU: EHIME PREFECTURE: Uwa-jima, Toko-name, *G. Koidzumi* in 1934 (KYO). KAGAWA PREFECTURE: Kida-gun, Mt. Goken-san, *S. Matsumoto* in 1905 (MAK). KOCHI PREFECTURE: Takaoka-gun, Mt. Yokogura, *M. Hori* in 1957 (OSA); Nakamura city, Hyakuwarai, *Y. Kanematsu* 186 (MAK); Mt. Nishiki-yama, *S. Kitamura* in 1949 (KYO, MICH); Suzaki city, Boku-no-kawa, *T. Makino* in 1889 (MAK); Iwado, *T. Makino* in 1892 (MAK); Nagaoka-gun, Mt. Shiraga-yama, *G. Murata* 10876 (KYO); Nagaoka-gun, Otoya-mura, Mt. Kajigamori, *G. Murata* 18679, 18682 (KYO); Takaoka-gun, Shimohayama-mura, State Forest of Todorō-yama, *M. Tagawa* 2707 (KYO); Mt. Yokogura, *S. Takafuji* in 1974 (KYO); Nanokawa, *S. Watanabe* in 1892 (GH, K); Kuromori, *without collector* in 1888 (TI). TOKUSHIMA PREFECTURE: Oe-gun, Yamakawa-cho, Mt. Takaetsu-yama, *T. Kasai* in 1917 (MAK); Anan city, Aratano-cho, Tairyuji, Ryuno-iwaya, *H. Koyama* 1134 (KYO, TNS); Miyoshi-gun, Nishi-iyayama-mura, Mt. Kunimi-yama, *G. Murata* 7692 (KYO); Kaibu-gun, Mugi-mura, *without collector* in 1909 (MAK 6920).

KOREA, NORTH. Vicinity of China-Korea border, *T. Kanashiro* 5573 (KYO); Kannan, Tokugen near Onen-san, *S. Kitamura* in 1932 (KYO); Fuzan city, *H. Migo* in 1969 (KANA).

KOREA, SOUTH. Cheju-do (Quelpaert Island), *I. C. Chung* 3098 (TNS), *U. Faurie* 1833 (G); Hallai-san, *T. Nakai* in 1913 (TI); Mt. Chii, *S. Okamoto* 17936, 17937 (KYO); Ham-Puk, Ra-nan, *T. Saito* in 1935 (KYO); Cheju-do (Quelpaert Island), Hongno, *E. Taquet* 131 (G), 831 (G, K), 4259 (G, LE).

KOREA, LOCALITIES UNKNOWN: Diamond Mts., *Mrs. R. Smith* 686 (US); Kangkai, *R. G. Mills* 774 (TI).

LAOS. Nong Et, *M. E. Poilane* 16823 (P).

VIETNAM. Tonkin, Cha Pa, *M. Petalot* 5094 (NY, P, US), *M. Hautefeuille* 110 (P); Tonkin, Ta Phing, *E. Poilane* 12825 (P); Mt. Pia-duac, Vam Kep, *M. Petalot* in 1922 (P).

*Circaea mollis* most closely resembles *C. lutetiana* subspp. *canadensis*, *quadrisulcata*, and *lutetiana* but can be distinguished from the former two subspecies by the pubescent stems, green buds and sepals, and darkened nodes and from the last by the globose, or nearly globose, strongly sulcate, ribbed fruits. From all subspecies of *C. lutetiana*, *C. mollis* differs by having lanceolate or broadly lanceolate leaves with cuneate leaf bases, in the generally smaller size of all floral parts, and in the shorter pedicels.

*Circaea mollis* is the most robust species of the genus and is approached in size only by the largest plants of *C. cordata*. It is also the only species in Asia that may be somewhat weedy. Although it is never found in recently disturbed habitats, it is quite frequent in later successional stages, in thickets along streams, roadsides, and abandoned rice paddies. It is the most common species of *Circaea* in *Cryptomeria* plantations throughout Japan at low elevations. *Circaea mollis*, under favorable conditions, may form extensive colonies of many square meters, but rarely dominates an area, tending most often to be intermixed with other coarse herbs, low shrubs, and vines. It is also the only species that approaches subtropical areas, ranging into the southernmost parts of the warm temperate zone at low elevations. Northward, *C. mollis* becomes local and is replaced in some similar situations by *C. lutetiana* subspp. *quadrisulcata*, which, however, does not occur in situations as disturbed as some of those in which *C. mollis* grows.

Except for size differences, which appear to be related to local environment, *Circaea mollis* is remarkably invariable throughout its range and is probably the least variable of the bilocular species of *Circaea*. The few characters that appear to be plastic are the shape of the leaf base, fruit shape, and presence or absence of a minute bracteole at the base of the pedicel. The presence of a bracteole and various shapes of the leaf base do occur sporadically throughout the range of the species, whereas plants with more slender fruits are more common in the western part of the range. L veill  (1907) based his *C. coreana* var. *sinensis* partially on this feature, which is much more pronounced in immature fruits. Mature fruits of such plants, however, approximate in shape and size fruits from throughout the range. This very slight difference does not warrant formal taxonomic recognition.

Bracteoles are infrequent in *Circaea mollis* and cannot be used as a diagnostic character. When bracteoles do occur, they are most commonly found subtending the lowermost pedicels of a raceme, and they may be lacking from the upper pedicels of the same plants. Occasionally they may be found only beneath a few of the middle pedicels or sporadically under non-adjacent pedicels. Shape of the leaf base may also differ on the same plant. Commonly, the lowest leaves are more apt to have rounded bases while those above may have broadly to narrowly cuneate bases. The lower leaves are usually deciduous by the time of flowering and fruiting and therefore not noticeable. The rounded leaf bases of immature plants make certain identification of these plants difficult since they may resemble the minutely pubescent forms of *C. erubescens* or the hybrids, *C. × dubia* (*C.*

*cordata* × *C. erubescens*) and *C. × ovata* (*C. cordata* × *C. mollis*). In flower or in fruit, there is no confusion among any of these.

#### 4. *Circaea lutetiana* L., Sp. Pl. 9. 1753.

Erect or rarely decumbent at the base, 1.2–9 dm tall, simple or rarely branched below the inflorescence, forming long rhizomes without tuberous thickenings, which give rise to the following year's plants from their tips. Plants glabrous to densely pubescent, the stem with one or a combination of the following hair types: soft, falcately recurved hairs, 0.2–0.3 mm long; capitate and clavate-tipped hairs ca. 0.4 mm long; soft, sharp-pointed, straight or slightly curved, patent hairs, 0.5–1 mm long. The petioles with soft, short, falcate, upwardly curved hairs or with hairs as on the stem. Leaves glabrous or, more commonly, pubescent, especially near the base of the blade and along the main veins on the lower, and occasionally also on the upper surface, with soft falcate hairs ca. 0.2 mm long, occasionally also with long straight hairs ca. 1 mm long if these present on the stem; interveinal areas not at all or less densely pubescent; leaf margins with short, curved cilia and also with long straight hairs if these present on the stem. Axis of the inflorescence densely covered with capitate and clavate-tipped glandular hairs, 0.2–0.4 mm long, the pedicels less densely so. Stem green or rarely the nodes brownish or purple. Leaves horizontally spreading, sometimes drooping at the tips, green, opaque; those below to those just above the middle of the stem the largest, (3–)4.5–16 cm long, 2–6(–12) cm wide, becoming gradually reduced in size upward and eventually bractlike and alternate at the base of the inflorescence; gradually reduced in size downward. Leaf shape highly variable, ranging from very broadly elliptic to deltoid ovate but most commonly ovate, lanceolate ovate or oblong ovate; short to long acuminate to the obtuse or subacute apex, very broadly cuneate to subcordate but most commonly rounded or truncate at the base, denticulate. Petioles (0.6–)1.3–5.5(–7.5) cm long, sparsely to densely pubescent with soft, upwardly curved falcate hairs ca. 0.2 mm long or, in subsp. *lutetiana*, sometimes with longer, straight or slightly curved hairs, 0.5–0.8 mm long, intermixed if these present on the stem; commonly with reduced branches arising in the axils. Inflorescence densely pubescent with capitate and clavate-tipped glandular hairs, 0.2–0.4 mm long; terminal on the main stem and rarely at the tips of short, uppermost axillary branches; a simple raceme or the raceme branched near the base, the lateral branches subtended by reduced leaves or leaflike bracts; the terminal raceme, from the uppermost reduced leaf or leaflike bract, 1.5–3 cm long at initiation of flowering, to 30(–40) cm long at cessation of flowering; the lateral racemes, 2–6 cm long at initiation of flowering, to ca. 20 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels, 1.9–5.2(–9) mm long, perpendicular to the axis of the raceme, pubescent, with capitate and clavate-tipped glandular hairs, 0.2–0.3 mm long, with or without a minute setaceous bracteole, 0.2–0.4(–7) mm long, at the base. Fruiting pedicels 3–6.5(–10) mm long. Buds pubescent, with short, soft, glandular hairs ca. 0.1 mm long, rarely glabrescent; green or purple, especially towards the apex, elliptic, oblong ovate to obovate in outline, rounded or acuminate to the obtuse apex; from the summit of the ovary, 2.3–4.5(–5.4) mm long, 1–2.3 mm thick just prior to anthesis. Ovary 1–2.2 mm long, 0.8–1.5 mm thick at anthesis, broadly fusiform,

clavate, obovoid to subglobose, densely covered with soft, translucent, uncinuate hairs. Floral tube 0.4–2.4 mm long, 0.1–0.3 mm thick at the narrowest point, linear obtriangular to funnelform in outline, often with short glandular hairs evenly distributed on the surface. Sepals 1.3–3.8(–4.5) mm long, 0.8–2.4 mm wide, densely to sparsely pubescent or glabrescent on the abaxial surface with hairs as on the buds; pale green or purple; very broadly elliptic, oblong to ovate, abruptly short acuminate to the obtuse or subacute apex, reflexed in flower. Petals 1–3.7 mm long, 1.4–3.4(–4) mm wide, more commonly wider than long, white or pink, broadly deltoid to broadly obovate or depressed broadly obovate in outline, obcordate; the apical notch 0.4–2(–2.4) mm deep,  $\frac{1}{3}$  to slightly over  $\frac{1}{2}$  the length of the petal. Stamens normally spreading at anthesis, shorter than, or equal to, rarely longer than the style; filaments (1.2–)1.8–3.5(–4.3) mm long; anthers 0.3–0.8(–1) mm long, 0.3–0.9 mm thick. Style erect, straight or slightly drooping at the tip, 1.8–5.5(–6) mm long, topped by an obconic, obtriangular or narrow, transversely oblong, scarcely to prominently bilobed stigma, 0.2–0.4(–0.6) mm tall, 0.3–0.9 mm thick. Nectar secreting disc conspicuous and exerted beyond the opening of the floral tube, 0.2–0.7 mm tall, 0.3–1.1 mm thick, cylindrical, occasionally dilated at the apex. Mature fruit 2.2–3.9(–4.5) mm long, 1.4–3.6 mm thick, clavate, obovate, pyriform to subglobose, narrowly to broadly rounded at the apex, tapering smoothly or obliquely rounded to the pedicel; bilocular and 2-seeded, with or without prominent ribs and sulci, densely covered with stiff, translucent, uncinuate hairs, 0.7–1.2 mm long and with short, capitate and clavate-tipped, glandular hairs ca. 0.1 mm long. Fruiting pedicels recurved to reflexed, often sharply so. Combined length of pedicel and mature fruit, (4.3–)6.3–11(–15) mm long. Gametic chromosome number,  $n = 11$ .

Distribution: Cool temperate deciduous forests. Europe and North Africa to southwestern Asia and from the European part of the Soviet Union to central Far Eastern Asia; eastern, southeastern and central North America. From near sea level to ca. 2,200 m. Flowering, June to late August and sporadically to early September.

*Circaea lutetiana* is treated here as being composed of three subspecies, *lutetiana*, *canadensis*, and *quadrisulcata*, occurring in three more or less isolated regions of the northern hemisphere, Europe, and North Africa to southwestern Asia; eastern North America; and eastern Europe from the vicinity of Moscow eastward between 50° and 60° N. Lat. to Far Eastern Asia.

*Circaea lutetiana* subsp. *canadensis* and *quadrisulcata* are obviously more closely related to each other than either is to subsp. *lutetiana*. *Circaea lutetiana* subsp. *canadensis* and *quadrisulcata* exhibit the classical pattern of disjunction between eastern North America and Asia (Fernald, 1915; Hara, 1939, 1952) although the Asian plants are not restricted to the eastern part of the continent as previously thought (Hara, 1952).

Although subsp. *canadensis* and *quadrisulcata* are placed in *C. lutetiana*, this might not ultimately prove to be the best treatment. I have combined the three subspecies on the basis of information provided by A. K. Skvortsov and P. H. Raven (pers. comm.), who maintain that *C. lutetiana* subsp. *lutetiana* and subsp. *quadrisulcata* intergrade in the European part of the Soviet Union and on



the fact that specimens of subsp. *lutetiana* from that region tend to be nearly glabrous whereas specimens of subsp. *quadrisulcata* from the same region tend to have more pubescent stems than plants from the eastern part of the range. Mature fruits, which are very different in the two subspecies and critical for identification, are, unfortunately, usually lacking on specimens that I have seen from this area of overlap. Extensive field studies by those in a position to do so are necessary to definitely resolve this situation. Specimens that appear to be intermediate between *C. lutetiana* subsp. *lutetiana* and *quadrisulcata* are listed following the specimens examined of subsp. *lutetiana*.

*Circaea lutetiana* subsp. *canadensis* and subsp. *quadrisulcata* are very similar and can be separated only using cryptic characters. The North American subsp. *canadensis* is generally larger in all floral parts than its Asian counterpart and nearly always has a minute bracteole at the base of the pedicel that is always lacking in *C. lutetiana* subsp. *quadrisulcata*. Hara (1952), in addition to the bracteole difference, also mentions that plants from North America commonly have green sepals and white petals while the Asian plants tend to have purple sepals and pink petals. The difference in color is unreliable and cannot be used diagnostically.

Mature fruits of *C. lutetiana* subsp. *canadensis* and *quadrisulcata* are pyriform to subglobose and have prominent, corky thickened ribs and deep sulci. Fruits of the North American subsp. *canadensis* are slightly larger. In contrast, the fruits of *C. lutetiana* subsp. *lutetiana* are obovoid to clavate and the longitudinal corky thickenings are either highly reduced or absent. Sulci are also lacking on the fruits of subsp. *lutetiana*. Specimens with immature fruit from the critical area of overlap of *C. lutetiana* subsp. *lutetiana* and *quadrisulcata* in European Russia tend to have the immature fruits flattened in pressing, obscuring the differences in morphology. *Circaea lutetiana* subsp. *lutetiana* also differs from subsp. *quadrisulcata* in other, more subtle ways. The floral tube in *C. lutetiana* subsp. *lutetiana* is almost always longer and more slender and the floral parts are generally larger than in subsp. *quadrisulcata*. In size of floral parts, *C. lutetiana* subsp. *lutetiana* compares favorably with subsp. *canadensis*.

#### KEY TO THE SUBSPECIES OF *CIRCAEA LUTETIANA*

- a. Fruit pyriform to subglobose, with prominent ribs and deep sulci, tapering obliquely to the pedicel; stem commonly glabrous except for a few falcate hairs on the upper part; floral tube funnellform, 0.4–1.2 mm long.
  - b. Pedicels with a minute bracteole 0.2–0.7 mm long at the base; plants of North America ..... 4a. subsp. *canadensis*
  - b. Pedicels without a minute bracteole at the base or, if so, the bracteole less than 0.2 mm long; plants of east central Europe to Far Eastern Asia ..... 4b. subsp. *quadrisulcata*
- a. Fruit clavate to obovoid, without prominent ribs and sulci, tapering smoothly to the pedicel; stem most commonly pubescent; floral tube very narrowly obconic to slender-funnelform, 0.8–2.4 mm long ..... 4c. subsp. *lutetiana*

#### 4a. *Circaea lutetiana* L. subsp. *canadensis* (L.) Asch. & Magnus, Bot. Zeitung (Berlin) 28: 787. 1870.—FIG. 9.

*Circaea lutetiana* L.  $\beta$  *canadensis* L., Sp. Pl. 9. 1753.  
*Circaea latifolia* Hill, Br. Herb. 138. 1756. Nom. illegit.  
*Circaea canadensis* (L.) Hill, Veg. Syst. 10: 21. 1765.

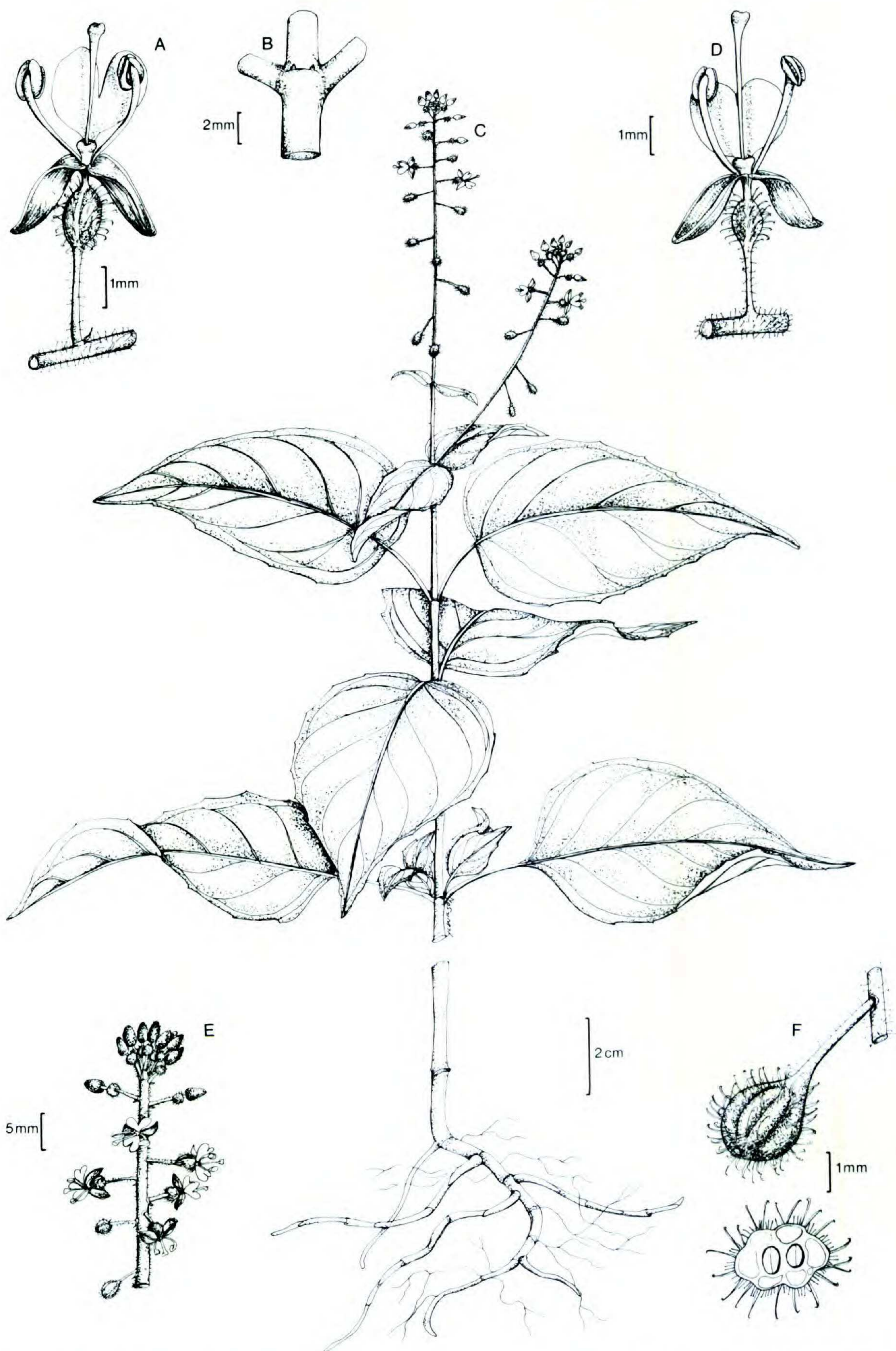


FIGURE 9. *Circaea lutetiana* L. subsp. *canadensis* (L.) Asch. & Magnus.—A. Flower with petal removed; note exserted nectary and bracteole at base of pedicel.—B. Upper node of stem.—C. Habit.—E. Inflorescence.—F. Fruit. After Boufford 18828 (CM, KYO, MHA, MO, PE). *Circaea lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Mag.—D. Flower with petal removed; note absence of bracteole. From Boufford & Wood 19765 (KYO, MO, PE).

- Circaea quadrisulcata* (Maxim.) Franchet & Savat. var. *canadensis* (L.) Hara, *Rhodora* 41: 387. 1939.  
*Circaea canadensis* (L.) Hill var. *virginiana* Fern., *Rhodora* 47: 161, *tab.* 896, *fig.* 1-4. 1945. TYPE:  
 United States, Virginia, Brunswick County, Seward Forest near Triplett, 23 June 1944, M. L.  
 Fernald & J. B. Lewis 14643 (GH, holotype; GH, MO, NY, POM, US, isotypes).  
*Circaea quadrisulcata* (Maxim.) Franchet & Savat. subsp. *canadensis* (L.) Löve & Löve, *Taxon* 31:  
 349. 1982.

Plants 1.2-9 dm tall. The stem glabrous, petioles, leaves and inflorescence pubescent as in the species but never with long, straight or slightly curved, patent hairs, 0.5-1 mm long. Leaves (5-)7-13(-16) cm long, (2.5-)3.5-6(-8.5) cm wide, narrowly to broadly ovate to, more commonly, oblong ovate. Petioles (1.3-)2.5-5.5 cm long. The terminal raceme ca. 2.5 cm long at initiation of flowering, to 30 cm long at cessation of flowering; the lateral racemes 2-5 cm long at initiation of flowering, to 20 cm long at cessation of flowering. Flowering pedicels 2-5(-6) mm long, with a minute, setaceous bracteole, 0.2-0.4(-7) mm long, at the base. Fruiting pedicels (3.5-)4-6.5 mm long. Buds (2.3-)3-4.1 mm long, (1.2-)1.5-2.3 mm thick just prior to anthesis, green or purple, especially towards the apex. Ovary 1.2-1.7 mm long, 0.8-1.3 mm thick at anthesis, obovoid to subglobose. Floral tube (0.4-)0.7-1.2 mm long, 0.2-0.3 mm thick at the narrowest point, funnelform. Sepals (1.9-)2.4-3.8 mm long, (1.2-)1.5-2.4 mm wide, very broadly elliptic, oblong to oblong-ovate, green or purple. Petals (1.3-)1.6-2.9 mm long, (1.5-)2.2-3.2(-4) mm wide, commonly white; the apical notch 0.4-1.7 mm deep,  $\frac{1}{3}$  to slightly over  $\frac{1}{2}$  the length of the petal. Filaments (1.2-)2-2.8 mm long; anthers 0.6-0.8 mm long, 0.5-0.8 mm thick. Style (2.5-)3.5-5.5 mm long; stigma 0.2-0.4 mm tall, 0.3-0.6 mm thick. Nectar secreting disc 0.2-0.7 mm tall, 0.5-1.1 mm thick. Mature fruit 2.8-3.9(-4.5) mm long, 1.9-3.6 mm thick, pyriform to subglobose, broadly rounded at the apex, rounded, usually obliquely, to the pedicel, with prominent ribs and deep sulci. Fruiting pedicels reflexed or recurved, often strongly so. Combined length of pedicel and mature fruit, 6.3-8(-11.2) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: Sheet I: 26 in the Linnaean Herbarium at Stockholm (S) can be taken as the lectotype. The sheet has "*Circaea*" and "E Virginia" written in Linnaeus' hand on the front along with "*Circaea lutetiana* var. *canadensis*" by Wikström. The sheet is annotated on the back "Virginia" in Solander's hand and "*Circaea lutetiana*  $\beta$  *canadensis*" by Casström. The specimen was probably collected by Pehr Kalm, who collected in Virginia in the 1740s.

Distribution (Fig. 10): Widespread in eastern and central North America in cool temperate deciduous forests. From southern Georgia to west central Oklahoma, north to central North Dakota and southeastern Manitoba, eastward along the southern edge of the Canadian Shield to Quebec, Nova Scotia, and New Brunswick. Local in the southeastern, southern and western parts of the range. From sea level to 1,800 m. Flowering, (early-)mid-June to mid-August and sporadically to early September.

#### Representative specimens examined:

CANADA. MANITOBA: Roseisle, bord du ruisseau, A. Champagne 22 (DAO); Lac du Bonnet, Stevenson's Point, G. M. Keleher 363 (WIN); 9 mi. N of Rathwell, near the Assiniboine, A. Champagne in 1946 (DAO). NEW BRUNSWICK: ALBERT COUNTY, Steeves-Hartley Bridge W of Hillsborough,

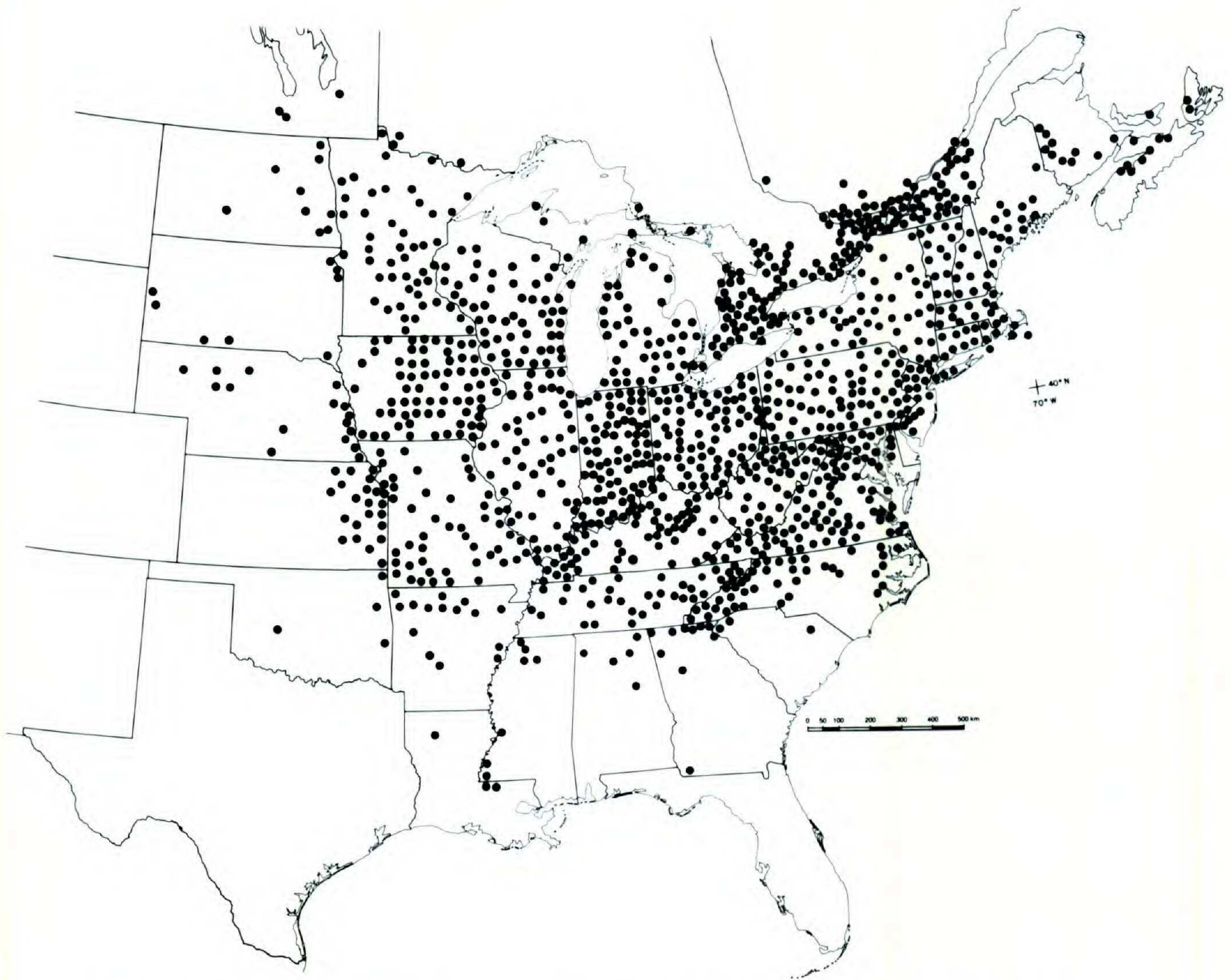


FIGURE 10. Distribution of *Circaea lutetiana* L. subsp. *canadensis* (L.) Asch. & Mag.

*H. Scoggan & D. Erskine in 1955* (ACAD); CARLETON COUNTY, Woodstock, *M. L. Fernald & B. Long 14204* (CAN, GH, PH), Woodstock, ca. 15 mi. NW of town, *H. J. Scoggan 13567* (ACAD, MAK, W), Perth, N of Woodstock, by St. John R., *H. J. Scoggan 12659* (CAN), Hartland, *P. R. Roberts 60-266* (UNB), 2 mi. SE of Hartland, *E. Smith & R. Clattenburg 20012* (ACAD), 1 mi. E of Richmond Corner on Houlton Road, *P. R. Roberts & B. Pugh 65-412* (UNB), Island Park, *P. R. Roberts & D. E. Drury 63-1463* (DAO) *63-1462* (UNB), near Jackson Falls, E side of Meduxnekeag R., *K. Heinste in 1965* (UNB), Jacksonville, Moody Hill, *D. Christie 2457* (DAO); KINGS COUNTY, no further data, *Britain in 1885* (CAN); YORK COUNTY, Nashwaak, Nashwaak R., *M. L. Fernald & A. S. Pease 25203* (CAN, GH, MT, NY, US), near Parcut Ferry, N side of St. John R., *K. Heinste in 1965* (UNB), Keswick, *P. R. Roberts 59-969* (UNB), in woods near Keswick, *E. Smith 19304* (ACAD, CAN), Queensbury, *V. Dippitt 799* (UNB), Dumfries, *W. A. Squires in 1963* (DAO). NOVA SCOTIA: COLCHESTER COUNTY, near Truro, *A. R. Prince & C. E. Atwood 1410* (DS, MICH); CUMBERLAND COUNTY, New Prospect, *W. B. Schofield 3419* (ACAD, CAN, DAO); HANTS COUNTY, Five Mile R., *A. S. Pease & B. Long 22003* (GH, PH), Upper Kennetcook, Lattie's Brook, *J. & D. Erskine 55576* (ACAD), Halfway R. above Hantsport, *J. S. Erskine 53293* (ACAD, DAO, TRT); INVERNESS COUNTY, Melford, *E. C. Smith et al. 8729* (ACAD, CAN, DAO, MT, TRT), Hillsborough, *E. C. Smith et al. 4838* (TRT) *999* (ACAD, DAL); KINGS COUNTY, Cape Blomidon, *W. B. Schofield 5225* (ACAD, CAN, DAO, MT, TRT), above White Rock, *J. S. Erskine 541175* (ACAD), Cambridge, Cornwallis R., *W. B. Schofield 77* (ACAD, DAL), above Cambridge Station, *J. S. & D. S. Erskine 50427* (DAL, DAO); PICTOU COUNTY, Intervale woods, Middle R., *D. Sampson 119* (ACAD, MT), West R., *E. C. Smith et al.* (ACAD). ONTARIO: ALGOMA DISTRICT, Prince Township, Gros Cap, *S. Losee 2512* (H); BRANT COUNTY, Brantford Township, Whiteman's Creek, *W. H. Minshall 3908* (DAO), Spottiswood Lake, 10 mi. S of Galt, *B. C. Frankton et al. 655* (DAO); BRUCE COUNTY,

Kincardine Township, Tiverton, *P. F. Maycock & A. Auclair 9140* (MIN, MTMG), Carrick Township, 3 mi. NW of Lakelet, *G. R. Thaler 399* (TRT), Eastnor Township, ca. 2 km NW of Hope Bay, *D. G. Cuddy & G. McConachie 1850* (CAN), near Kemble, *H. Reeves in 1951* (TRT), Carrick Township, 1 mi. N of Belmore, *G. R. Thaler 397* (TRT); CARLETON COUNTY, Brittonia Park, *A. W. Anderson in 1945* (CAN), *Fr. R. Germain 1272* (CAN, TRT), Carsonby, 2 mi. N of N Gower, *J. Op de Beeck in 1968* (MTMG), Gloucester Township, *W. H. Minshall 3323* (DAO), Fitzroy Township, *W. H. Minshall 3300* (DAO, RM), Nepean Township, Woodroffe, *W. H. Minshall 1821* (BH, DAO, MIN, NA, NY), Gloucester Township, Rideau R., *W. H. Minshall 294* (DAO, NA, NY), Osgoode Township, 2 mi. SW of Manotick Station, *W. G. Dore 14379* (DAO), Ottawa, Dow's Swamp, *L. Jenkins 3050* (DAO, W), Riopelle Island, Ottawa R., *H. Groh 5203* (CAN), Beechwood, *J. M. Macoun in 1891* (TRT), Cunningham Island, Ottawa R., *H. Groh 5389* (CAN, DAO) *W. F. Reeve 6561* (UBC); DUFFERIN COUNTY, 2.5 mi. N of Orangeville, *G. R. Thaler 277* (TRT), 0.25 mi. S of Terra Nova, *W. J. Cody 21429* (DAO); Durham County, Cartwright Township, 3 mi. NE of Blackstock, *E. Haber 539* (CAN, DAO, MTMG, TRT); ELGIN COUNTY, Port Stanley, *W. J. Cody 1956* (DAO), Yarmouth Township, near St. Thomas, *L. E. James in 1950* (DAO), 5 mi. SE of St. Thomas, *L. E. James 1791* (DAO, DUL, MT, TRT, W), 1 mi. W of Port Bruce, Lake Erie, *H. A. Senn 3265* (DAO, TRT), 4 mi. N of Dutton, *J. H. Soper & H. M. Dale in 1948* (TRT); Essex County, Sandwich W Township, 1 mi. E of LaSalle, *J. K. & M. E. Shields 1395* (CAN, TRT) *1471* (ACAD, HAM, TRT), Sandwich S Township, 4 mi. from central Windsor, *J. K. & M. E. Shields 1372* (HAM, TRT), Gosfield S. Township, 4.25 mi. SW of Kingsville, *J. K. Shields & J. H. Soper 1431* (TRT), 4 mi. NW of Kingsville, *J. K. & M. E. Shields 1444* (ACAD, MIN, TRT), S side of Windsor, *W. G. Dore & C. J. Marchant 2409* (DAO); FRONTENAC COUNTY, Howe Island, *W. J. Cody & D. Munro 22471* (DAO, TRT), Milton Island, *W. J. Cody & D. Munro 22577* (DAO), ca. 3 mi. ENE of Kingston, *W. G. Dore 18099x* (DAO), 5 mi. W of Kingston, *W. G. Dore & J. W. Kemp 16771* (DAO), Kingston, *J. Fowler in 1893* (MO) *in 1897* (US), Loughborough Township, Upper Rock Lake, *J. M. Gillett 6568* (DAO, MIN, NY, TRT), Frontenac Park, 1 km W of Salmon Lake, *R. Hainault & I. Macdonald 5146* (CAN, H, SASK), Cartwright's Point, Kingston, *E. Leach 420* (TRT), 7 mi. below Kingston, *F. W. Pennell 16286* (PH); GATINEAU COUNTY, Hull Township, Tenaga, *R. L. Gutteridge 903* (DAO), Gatineau Park, E of Ridge Road, *H. A. Senn et al. 1034* (DAO, WIS) *1033* (MO), Gatineau Park, Eardley Township, *J. M. Gillett 730* (DAO, UTC); GLENGARRY COUNTY, Colquhouns Island, *G. N. Gogo 472* (DAO); GRENVILLE COUNTY, Prescott, 1.8 mi. W of center of town, *W. G. Dore & J. M. Gillett 18068* (DAO), 2 mi. N of Prescott, *W. G. Dore et al. 18050* (DAO), 3 mi. SW of Prescott, *W. G. Dore* (DAO); GREY COUNTY, Jones Falls, W of Owen Sound on Hwy 6, *D. E. Boufford 18814* (BM, CM, G, K, KYO, MHA, MO, P, S), Holland Township, W of Arnott, *J. G. Grevatt 134* (TRT), Meaford, *W. Mauger 108* (MT); HALDIMAND COUNTY, Moulton Township, 2 mi. E of Dunnville, *B. Miller 428* (HAM), Port Dover district, *H. J. Scoggan 14180* (TRT); HALIBURTON COUNTY, Stanhope Township, Carnarvon, *V. Connolly 447* (TRT), Guilford Township, *E. & E. Sketton 452* (TRT); HALTON COUNTY, Nassagaweya Township, ca. 1.5 mi. N of Campbellville, *P. M. Catling & K. L. McIntosh in 1974* (TRT), Lake Crawford, *W. F. Grant 21* (HAM), near Hamilton, Waterdown, *J. H. Soper 950* (TRT); HASTINGS COUNTY, no further data, *J. Macoun in 1871* (MTMG), Marmora Township, Crowe Lake, *J. M. Gillett 7456* (DAO); HURON COUNTY, Clinton, *A. Cosens in 1900* (TRT), 10 mi. S of Clinton, *J. B. Phipps & J. B. Smith 3921* (TRT), Hullett Township, 2.5 mi. SE of Londesborough, *G. R. Thaler 177* (TRT), Tuckersmith Township, 2.5 mi. W of Seaforth, *G. R. Thaler 178* (TRT), Grey Township, Brussels, 5.5 mi. NE, *G. R. Thaler 228* (TRT), Stephen Township, 3 mi. S of Dashwood, *G. R. Thaler 252* (TRT), Usborne Township, 3 mi. N of Kirkton, *G. R. Thaler 252a* (TRT), Tuckersmith Township, 3 mi. NE of Hensall, *G. R. Thaler 275* (TRT), Stanley Township, 5 mi. NW of Hensall, *G. R. Thaler 300* (TRT), 4 mi. NW of Zurich, *G. R. Thaler 308* (TRT), McKillop Township, 1.5 mi. NE of Seaforth, *G. R. Thaler 408* (TRT), 4 mi. N of Seaforth, *G. R. Thaler 412* (TRT), Hay Township, 2 mi. SE of Zurich, *G. R. Thaler 421* (TRT), Goderich Township, 4 mi. N of Bayfield, *G. R. Thaler 440* (TRT); KENT COUNTY, Rondeau Park, *W. S. Dickinson 573* (CAN, DAO, TRT), Camden Township, 3 mi. S of Thamesville, *J. M. Gillett 16854a* (DAO, TRT), Rondeau Park, *R. W. Neal 358* (HAM), Rondeau Park, by Lake Erie, *H. J. Scoggan 14787* (CAN, TRT), Oxford Township, 1.5 mi. N of Clearville, *J. H. Soper & H. M. Dale 4091* (ACAD, DAO, GH, MIN, MO, MT, TRT); LANARCK COUNTY, 1.5 mi. E of Bathurst St., *R. A. Lubke 828* (TRT), Ramsay Township, Almonte, Lots 15 & 16, *W. H. Minshall 1740* (DAO); LEEDS COUNTY, Thwartway Island, *W. J. Cody & D. Munro 22378* (DAO), Grenadier Island, *W. J. Cody & D. Munro 22788* (DAO), Endymion Island, *W. J. Cody & D. Munro* (DAO), McDonald Island, *W. J. Cody & D. Munro 22508* (DAO), Gordon Island in the St. Lawrence R., *W. G. Cody et al. 19677* (DAO, TRT), Oliver's Ferry, *T. Edmonson in 1898* (NY), Crosby Township, Queen's Biological Station, Lake Opinicon, *J. M. Gillett 1468* (DAO), W Grenadier Island, *D. Munro 1* (DAO), Lake Opinicon, S Crosby Township, *J. Shields 569* (ACAD, TRT), near Chaffey's Locks, *R. Erskine 14962* (ACAD), Hay Island, Gananoque, *G. Kennedy in 1908* (GH); LINCOLN COUNTY, 2 mi. N of Queenston, *T. R. Davidson 115* (DAO), Niagra Township, 2 mi. SW of Queenston, *B. Miller 342* (HAM), near Jordan, *J. H. Soper & K. K. Shields 4882* (CAN, HAM, MO, MT, TRT),

Gananoque, *J. M. Stewart* 58 (HAM), Jordan Harbour, *T. Taylor* 73 (TRT); MANITOULIN DISTRICT, Kagawong, between Bridal Veil Falls & Bay, *K. Winterhalder* 8580 (CAN); MIDDLESEX COUNTY, London, *T. J. W. Burgess in 1878* (MTMG), *T. J. W. Burgess in 1879* (US), *T. Millman in 1879* (TRT), Univ. of W Ontario, *G. F. Ledingham* 5643 (USAS), *W. H. Minshall* 4465 (DAO), Glencoe, *N. D. Keith in 1893* (MTMG), 3 mi. SE of Granton, *J. K. Shields* 155 (TRT), 1.5 mi. SW of Granton, *G. R. Thaler* 285 (TRT), 2 mi. NW of Iderton, *G. R. Thaler* 287 (TRT), 2.5 mi. N of Lobo, *G. R. Thaler* 289 (CAN, TRT), 4 mi. N of Lucan, *G. R. Thaler* 387 (TRT), Strathroy, *G. M. Stirrett* 1497 (DAO); MUSKOKA COUNTY, Port Carling, *L. E. Coleman in 1938* (TRT), 1.75 mi. NE of Kilworthy Station, *R. E. Whiting* 758 (TRT), Benusoleil Island, Frying Pan Bay, *G. R. Thaler* 337 (TRT); NORFOLK COUNTY, Port Royal, S Walsingham Township, *J. E. Cruise* 5099 (BH, CAN, TRT), Woodhouse Township, Marlburg, *J. E. Cruise* 9853 (TRT), Long Point, Lake Erie, *J. B. Falls & W. L. Klawe* 655 (TRT), Charlotteville Township, Lot 18, *M. Landon* 494 (HAM), 2 mi. N of Middleton, *P. F. Maycock & O. B. Maryniak* 6221 (MTMG), Turkey Point, Lake Erie, *W. M. Bowden in 1935* (HAM), *H. J. Scoggan* 14907 (CAN), *J. H. Soper* 288 (TRT), 4 mi. SW of Tillsonburg, *W. Stewart* 1016 (DAO); NORTHUMBERLAND COUNTY, Presqu'ile Pt. Provincial Park, *M. G. Dumais* 398 (TRT); ONTARIO COUNTY, 2.5 mi. N of Leaksville, *P. M. Catling & S. McKay in 1970* (TRT), 6 mi. W of Enniskillen, *L. Gad et al. in 1974* (TRT), Swiss Chalet Park, *E. Haber* 557 (DAO, MTMG, NCU, TRT), Uxbridge Township, 1 mi. SE of Sky Lodge, *M. Heimburger in 1950* (TRT), Rouge R., *J. L. Riley in 1973* (TRT), Scolasticat St. Joseph, *R. Gilbert* 21 (DAO); OTTAWA-CARLETON COUNTY, Billing's Bridge, *W. H. Minshall in 1933* (DAO), N Gower, *J. M. Wallace s.n.* (SASK), Rockcliffe Park, Ottawa, *M. E. Forward in 1935* (UBC), *H. Lloyd in 1944* (CAN); OXFORD COUNTY, N Norwich Township, *T. Hinks in 1971* (TRT), 3 mi. W of Embro, *P. F. Maycock & O. B. Maryniak* 6650 (MTMG), 3 mi. SE of Granton, *J. K. Shields* 155 (CAN, HAM, MO, MT), N Norwich Township, *L. Stock in 1954* (TRT), 6 mi. N of Embro, *G. R. Thaler* 380 (TRT), 3 mi. from Ingersoll, *G. R. Thaler* 383 (TRT), end of Sunova Lake, *G. L. Thaler* 404 (TRT), 4 mi. SW of Hickson, *G. R. Thaler* 406 (TRT), 2 mi. NE of Innerkip, *G. R. Thaler* 436 (TRT); PAPINEAU COUNTY, Templeton Parish, *J. A. Calder M-137* (DAO); PARRY SOUND DISTRICT, Big Island, *E. McDonald* 562 (US); PEEL COUNTY, Credit Forks, *H. H. Brown in 1929* (TRT, UBC), 3 mi. NE of Brampton, *P. F. Maycock & B. W. Davies* 11423 (MTMG), Chinguacousy Township, *H. Saifu et al. in 1974* (TRT), Caledon, *M. Vickers* 67 (TRT), Snelgrove, *J. White in 1908* (TRT); PERTH COUNTY, Elma Township, 3 mi. S of Listowel, *G. R. Thaler* 170 (TRT), Wallace Township, 2 mi. E of Listowel, *G. R. Thaler* 173 (TRT), 3 mi. S of Palmerston, *G. R. Thaler* 181a (TRT), 3 mi. N of Motherwell, *G. R. Thaler* 254 (TRT), 1 mi. E of Fullarton, *G. R. Thaler* 259 (TRT), 2.5 mi. NE of Staffa, *G. R. Thaler* 271 (TRT), 1.5 mi. NE of Granton, *G. R. Thaler* 386 (TRT), 1 mi. N of Kinkora, *G. R. Thaler* 434 (TRT), 1.5 mi. SE of Avonton, *G. R. Thaler* 435 (TRT), 2.5 mi. S of Brodhagen, *G. R. Thaler* 458 (TRT); PETERBOROUGH COUNTY, Sandy Lake, *J. E. Cruise* 101 (TRT); PRESCOTT COUNTY, 4 mi. W of L'Original, *H. A. Senn* 1614 (DAO, MT, NY), 3-6 mi. SE of Hawksbury, *W. H. Minshall* 1496 (DAO); PRINCE EDWARD COUNTY, Picton, *J. Macoun* 673 (GH), Rainy River District, SE corner of Basswood Lake, *C. E. Garton* 4919 (DAO, MT, TRT), 4 mi. SW of Sleemans, *C. E. Garton* 8886 (DAO, UC), Lake of the Woods Provincial Park, McCrosson Township, *C. E. Garton* 9166 (DAO, MIN, SASK, TRT), 2.5 mi. below Rainy River Town, *C. E. Garton* 9389 (DAO, MAK, UBC); RENFREW COUNTY, 2 mi. E of Renfrew, *B. Boivin & L. J. van Rens* 14306 (DAO), 2 mi. W of Renfrew, *J. H. Soper* 9345 (TRT), Haley Station, *T. Edmonson* 2597 (NY); RUSSELL COUNTY, Casselman, *J. Macoun* 2018 (CAN); SIMCOE COUNTY, Lake Simcoe, DeGrasse Point, *C. E. H.* 108 (TRT), Midland, *T. M. C. Taylor* 8379 (TRT), Minesing Swamp near Barrie, *S. Walshe* 238 (CAN, DAO, TRT); STORMONT COUNTY, Sheek Island, Ault Park, *J. M. Gillett & W. G. Dore* 7648 (ACAD, DAO, NCU), Steen Island, St. Lawrence R., *J. M. Gillett* 7700 (DAO, TRT), 2 mi. NE of Wales, *J. M. Gillett* 7746 (DAO, MT), 2 mi. W of Cornwall, *J. Op de Beeck in 1968* (MTMG), 2 mi. NW of Maxville, *M. J. Shchepanek & A. Dugal* 1546 (CAN), Newington, *J. H. Lemon in 1895* (UBC); VICTORIA COUNTY, 3 mi. W of Norland, *W. J. Cody & J. A. Parmelee* 6666 (DAO), 0.5 mi. E of church in Dalrymple, *W. S. Dickinson* 414 (CAN, DAO, MTMG, NCU, TRT); WATERLOO COUNTY, Galt, *W. Herriot in 1910* (CAN, DAO, MT, TRT), Hamburg, *H. L. Merner in 1897* (WIS), German Mills, Cressman's Woods, *E. L. James* 264 (HAM), 3 mi. NE of Linwood, *G. R. Thaler* 295 (TRT), 3 mi. SW of Elmira, *G. R. Thaler* 298 (TRT), Waterloo, *P. Hayne in 1973* (VDB), Kitchener, *G. R. Thaler* 363 (TRT); WELLAND COUNTY, Bertie Township, Bowen Road, *B. Miller* 213 (HAM, TRT), Niagra, *W. J. Potter in 1908* (TRT), Niagra Falls, *J. Macoun* 44424 (GH), Niagra Gorge, *B. Miller* 456 (DAO, HAM), 8 mi. W of Welland, *D. R. Lindsay* 236 (DAO), 4 mi. NE of Winger, *L. C. Sherk et al.* (DAO); WELLINGTON COUNTY, Guelph, *H. Hood in 1956* (SASK), *J. J. Stroud in 1937* (TRT); WENTWORTH COUNTY, Red Hill, *R. S. Maines* 80 (HAM), 2.5 mi. SW of Freelton, *S. J. Ives* 74 (CAN, TRT), Cootes Paradise, Royal Botanical Garden, *J. B. Lord* 47a (HAM), 0.5 mi. S of Winona, *P. F. Maycock & O. B. Maryniak* 1868 (MTMG), Hamilton, Dundas Marsh, *W. W. Judd* 141 (HAM), Hamilton, *J. A. Riddell* 54 (HAM), Hamilton, Sassafra Point, *F. Caesar* 227 (HAM); YORK COUNTY, Concord, *H. H. Brown in 1928* (TRT), Pottageville, *H. H. Brown* 4205 (TRT, UBC), Toronto, Serena Grundy Park, *E. Haber* 540 (CAN, TRT), ca. 3 mi.

NE of King, *E. Haber* 542 (CAN, DAO, MTMG, TRT), ca. 3 mi. NW of Nobleton, near Bolton, *E. Haber* 554 (CAN, DAO, MTMG, NCU, TRT), ca. 1.5 mi. SW of Happy Valley, *D. Hoy et al.* in 1977 (TRT), Toronto, local woods, *L. T. Owens* in 1947 (TRT), Scarborough Township, *W. W. Robbins* in 1908 (DAO), 1.5 mi. NW of Aurora, *J. K. Shields* 899 (CAN, TRT), 3 mi. E of Kleinburg, *J. H. Soper & H. M. Dale* 4133 (DAO, GH, MIN, MO, MT, TRT, US), near Pottageville, *W. R. Watson* 2744 (TRT), Islington, *H. E. Welch* 96 (DAO). PRINCE EDWARD ISLAND: Savage Harbour, *J. S. Erskine* 00167 (ACAD). QUEBEC: ARGENTEUIL COUNTY, vicinity of Chatam, St. Philippe d'Argenteuil, *J. B. McConnell* in 1870 (MTMG), Calumet, *F. Adrien* 1299 (MT), Chatham Township, between Cushing & Ottawa R., *L. Jenkins* 7296 (DAO, WIN); ROBERT BALDWIN COUNTY, Pierrefonds, Cap St. Jacques, *E. Parnis* 1522 (MTMG); BEAUHARNOIS COUNTY, Valleyfield, *A. Vezina* V-4 (DAO), Ile Hébert in St. Lawrence R., *A. Bouchard & M. C. Herbert* 2154 (MTMG); BEAUHARNOIS & CHATEAUGUAY COUNTIES, Iles de la Paix, Ile Lucas, *M. Morency* 1355 (MT), Ile a Thomas, *M. Morency* 1038 (MT), Ile du Large, *M. Morency* 786 (MT), Ile a Tambault, *M. Morency* 956 (MT); BELLECHASSE COUNTY, Vallier, pointe Amos, *Y. Desmarais* 1180 (CAN, MTJB), St. Valier, *J. Cayouette* 1172 (H); BROME COUNTY, Brome Mt., *A. Walther & A. Auclair* in 1962 (MTMG), *A. Walther* in 1962 (MTMG); CHAMBLY COUNTY, near Longueuil, *M.-Victorin* 11269 (MT, WS), Chambly, *Fr. Cleonique* 4274 (DAO, MT), *Fr. David* in 1932 (MT), St. Bruno, *C. Morin* 201 (MT); COMPTON COUNTY, Chartierville, *A. Roy* 598 (MT); Deux Montagnes County, Ste. Scholastique, *D. E. Swales* 3750 (MTMG), near St. Jerome, *M.-Victorin* 11270 (MT, PH), Ste. Placid, *M.-Victorin et al.* 2059 (DAO, W, MT), Oka, *J. R. Beaudry* 58-223 (MT), La Trappe, *P. Louis-Marie* 24083 (MT); DRUMMOND COUNTY, 6.5 mi. NW of Richmond, *G. & P. H. Du Boulay* 1039 (MTMG), 2 mi. W of Ste. Felix de Kingsey, *S. Brisson* 762036 (MTMG, NLU); FRONTENAC COUNTY, St. Hilaire, *H. H. Lyman* in 1877 (MTMG); GATINEAU COUNTY, Mont Ste. Marie, *W. G. Dore & F. J. Beales* 22503 (MTMG), Wakefield, *J. Macoun* 59938 (CAN), Blue Sea Lake, *A. E. Porsild* 6361 (CAN), Meach Lake, *R.-Germain* 6187 (CAN), *M. Malte* 428/23 (CAN, W), *Br. Rolland* 6187 (GH, MT), Hull, *J. Macoun* in 1884 (NY), Gatineau Park, Skyline Trail, *H. A. Senn* 2058 (DAO, RSA), E end of Ridge Road, *H. A. Senn et al.* 1033 (DAO), Gatineau Park, *J. M. Gillett* 14245 (CAN), Lake Gauvreau, *F. W. Pennell* 16553 (PH), Mont Ste. Marie, *W. G. Dore* 22388 (DAO), Ironside, Gatineau valley, *M.-Victorin* 15901 (GH, MT); HOCHELAGA COUNTY, Otrement Mt., *P. F. & T. Maycock* 9332 (MTMG, NCU), Mont Royal Mt., *A. Walther & A. Auclair* in 1962 (MTMG), Mont Royal, *E. Roy* 2948 (DAO, MT), *M.-Anselme* in 1931 (MT, UC); HULL COUNTY, Kingsmere, Skyline Trail, *I. & T. Owen* 972 (DAO); HUNTINGDON COUNTY, Port Lewis, *A. Bouchard* 67178 (CAN, MTMG), Ross Island, *G. N. Gogo* 471 (DAO); IBERVILLE COUNTY, 2 mi. E of Iberville, *I. J. Bassett & A. Hamel* 2457 (DAO), 1.5 mi. E of Ste. Gregoire, *I. J. Bassett & C. W. Compton* 5563 (DAO), Mt. Johnson, *A. Walther* in 1962 (MTMG); JACQUES CARTIER COUNTY, Senneville, *L. M. Terrill* 2743 (MTMG), Valois, 1 mi. N of Lake St. Louis, *M. Jones* 213 (MTMG), SW end of Ile St. Paul, *P. F. Maycock* 7716 (MTMG); JOLLIETTE COUNTY, *A. Robert* 325 (MT), St. Ambroise, *P. Louis-Marie & H. Dudemaine* 1399 (CAN); LAVAL COUNTY, Laval Ouest, W from rte 8, *J. Op de Beeck* in 1968 (MTMG); LEVIS COUNTY, Lauzon, behind Fort no. 1, *R. & R. Cayouette* 35-119 (OSC), Harlaka, *Fr. Michel* 2278 (MT); LOUIS HÉBERT COUNTY, Laval, Univ. Laval, *J. G. Perras* 70-321 (DAO, MAK); MEGANTIC COUNTY, Leeds Township, at Osgoode R. bridge, *J. A. Bailey* 1623 (V); MISSISQUOI COUNTY, St. Armand, *M. Raymond & B. Boivin* 1266 (DAO, MTJB, WIN), Philipsburg, *C. Knowlton* in 1923 (GH, MO), Philipsburg Sanctuary, *A. Johnstone* in 1963 (DAO, MTMG), *A. Pokorny* in 1964 (MTMG); MONTMAGNY COUNTY, Ile aux Grues, *J. Rousseau* 25249 (GH, MT, PH, US), Grosse Ile, *M.-Victorin et al.* 40024 (MT), *R. P. Hanson* 325 (DAO), *J. Sexsmith* in 1944 (ALTA); MONTMORENCY COUNTY, St. Joachim, *V. Lavoie & D. Doyon* 600803-10 (DAO), Ile d'Orleans, St. Famille, *B. Boivin et al.* 60001 (CAN, MT, NY, WIS, WS), Ste. Pétronille, *D. Doyon* DL610721-31 (DAO), Ile d'Orleans, *M.-Victorin* 16176 (GH, MO, MT, POM, WS), Cap Tourmente, *M.-Victorin & R.-Germain* 46511 (GH, MT), *M.-Victorin* 15900 (MO, MT, NY, WS), SW end of Ile d'Orleans, *L. J. Uttal* 11931 (VPI), Ange-Gardien, *V. Lavoie & D. Doyon* 600712-11 (DAO); MONTREAL & JESUS ISLANDS COUNTY, Montreal, *E. Rouleau* 329 (MT), Beaconfield, *G. G. Campbell* in 1892 (MTMG), Ile St. Helene, *E. Rouleau* 1090 (MT), Ile Bizard, *C. Marcoux* in 1940 (DAO); NICOLET COUNTY, Nicolet, *F. Stanislas* 567 (MT), St. Sylvere, Maddington, *S. Brisson* 68166 (CAN, CAS, DAO, H, MIN, TUR); PAPINEAU COUNTY, (Hull County?), Lake McGregor, *R. Gilbert* 26 (DAO), 3 mi. NE of Poltimore, *M. J. Shchepanek & A. Dugal* 984 (CAN), Buckingham, *R. Ross & E. Rouleau* 7 (GH, MT); PONTIAC COUNTY, E of Shawville, *W. G. Dore* 18422 (DAO), Onslow Parish, 1 mi. S of Wyman, *M. N. Zinck* 856 (DAO); PORTNEUF COUNTY, Les Ecureuils, *D. Doyon & J. Deschenes* 600725-04 (ACAD); QUEBEC COUNTY, Sillery, *C. Rousseau* 63-1301 (DAO, MT, TRT, UBC, UC), Giffard, *D. Doyon* D61071916 (TRT), Quebec, *P. L. Marie* in 1929 (KYO), Parc du Pont, *R. Cayouette* 46-7 (DAO), Cap Rouge, *Fr. Michel* 1359 (MT); ROUVILLE COUNTY, Ile des Soeurs, Verdun, *S. Vincent* in 1942 (MT), Rougemont Mt., *A. Walther & A. Auclair* in 1962 (ACAD, MTMG, NY), Rougemont, *L. Cinq-mars et al.* 65-115 (DAO, MAK), Mt. Yamaska, *Fr. Fabius* 5532 (DAO), *A. Walther* in 1962 (NY), Mt. St. Hilaire, *P. F. Maycock & O. B. Maryniak* 3180 (CAN, DAO, MTMG, TRT), St. Hilaire, *M.-Victorin & R.-Germain* 46801

(DAO, GH, MT), Belsoeil Mt., *L. M. Terrill 1749* (MTMG); ST. JEAN COUNTY, St. Jean, *M. Raymond 9003* (MT); SHEFFORD COUNTY, Granby, *Fr. Fabius 331* (CAN, MT); SHERBROOKE COUNTY, 2 mi. N of Coaticook on hwy 22, *A. Bouchard et al. 69-651* (MTMG), city of Sherbrooke, *S. Brisson 761016* (MTMG, NLU), *A. Legault 6528* (COLO, DAO, MTMG, TRT, UBC); Stanstead County, Lake Memphremagog, *J. R. Churchill in 1903* (MIN), Georgeville, *J. R. Churchill in 1902* (BH, GH, MO, MT), Libbyton, 4 mi. S of Ayers Cliff, *G. & P. H. Du Boulay 1305* (MTMG); TERREBONNE COUNTY, Rosmere, *E. Rouleau 733* (MT), Morris Island in R. des Milles Iles, *P. F. Maycock et al. 12463* (MTMG); TIMISKAMINGUE COUNTY, Lake Timiskaming, Ile du College, *W. K. W. Baldwin 5274* (CAN, MT, TRT); VAUDREUIL COUNTY, Ile Perrot, *D. E. Newton in 1931* (MTMG), Rigaud, *E. Roy 3245* (ACAD, CAN, MT, NY), *E. Roy 3907* (DAO, FSU, MT, PH, TRT), Rigaud Mt., Pitcairn's Pond, *D. E. Swales 3579* (MTMG), Rigaud Mt., Ranches Riding School, *A. Pokorny in 1963* (MTMG), Mt. Rigaud, *L. Newstrom 402* (MTMG).

UNITED STATES. ALABAMA: CULLMAN COUNTY, Hurricane Creek Park N of Cullman, *R. Kral 35373* (KANU, VDB); FRANKLIN COUNTY, vicinity of Russellville, *L. James 22* (MO); JACKSON COUNTY, under Porter's Bluff, *L. Porter in 1934* (GH); MARSHALL COUNTY, SSW of Guntersville along Big Spring Creek, *R. Kral 34822* (AUA, KANU, MO, VDB); TALLADEGA COUNTY, Salt Creek USDA Soil Conservation Service dams site no. 18, *R. C. Clark & T. A. Heard 2936b* (NCU). ARKANSAS: BENTON COUNTY, Cave Springs, *N. C. Fassett & E. L. Nielson 19793* (WIS); CRAIGHEAD COUNTY, vicinity of Monette, *D. Demaree 3327* (UARK); GARLAND COUNTY, Hot Springs, 20 mi. W on Cedar Glade Road, *F. J. Sculls 318* (POM); HOT SPRINGS COUNTY, Magnet Cove, *D. Demaree 19349* (MO, SMU); INDEPENDENCE COUNTY, P. O. Batesville, *D. Demaree 26729* (MIN, OKL, OKLA, RSA, STAR, RSA, UNA); IZARD COUNTY, approx. 8 mi. W of Cushman, *R. D. Thomas & J. Gray 9145* (NLU, WTU); LEE COUNTY, Mariana, Crowley's Ridge, *D. Demaree 12987* (DS, MO, NY, PH, SMU); LOGAN COUNTY, Magazine Mountain, *D. Moore 480343* (UARK); MADISON COUNTY, Withron's Springs, *J. T. Buckholz in 1923* (SMU, UARK, WIS); MARION COUNTY, Cotter, *E. J. Palmer 5944* (COLO, CU, H, MO, NDA, POM); NEWTON COUNTY, Terrapin Branch, Sect. 26, T14N, R23W, *P. L. Redfearn & W. Weber 27504* (NCU, UMO); PHILLIPS COUNTY, Helena, Crowley's Ridge, *D. Demaree 19009* (CAS, GH, ISC, MIN, MO, NY, SMU, UC); SEARCY COUNTY, 1 mi. W of U.S. 65 on Peyton Creek, *D. Lawson & Bio 451* (NLU); STONE COUNTY, 8 mi. N of Mountain View, *D. Moore in 1949* (UARK, WIS); WASHINGTON COUNTY, Natural Sidewalk, *D. M. Moore 470098* (WIS). CONNECTICUT: FAIRFIELD COUNTY, Orchard Point, Vaughn's Neck, Candlewood Lake, *F. C. Seymour 19921* (MO); HARTFORD COUNTY, Avon, along Farmington R., *F. C. Seymour 29818* (MO, NY); LITCHFIELD COUNTY, E of Salisbury, *D. E. Boufford & H. E. Ahles 18832* (KYO, MO); MIDDLESEX COUNTY, Haddam, Haddam Meadows, *F. C. Seymour 27440* (MO); NEW HAVEN COUNTY, Bethany, Bethany Bog, just NW of Bethany airport, *K. L. Chambers 1519* (DAO, DS, NCU, OSC, TUR, WS, WTU); NEW LONDON COUNTY, town of Franklin, *R. Woodward in 1906* (NEBC); TOLLAND COUNTY, Storrs, Mansfield Township, *M. Travis 2500* (NA, PENN); WINDHAM COUNTY, Killingly, *C. A. Weatherby 5853* (US). DELAWARE: NEW CASTLE COUNTY, near Centerville, *A. Commons in 1873* (PH). DISTRICT OF COLUMBIA: N of Washington, *S. F. Blake 6929* (LL). GEORGIA: DADE COUNTY, near Murphy Spring in Murphy Hollow, between Sand & Murphy Mts., *W. H. Duncan & H. Venard 13074* (GA); DECATUR COUNTY, woods, *J. P. Anderson in 1888* (MO); FANNIN COUNTY, N of Cooper Creek Recreation Area, *D. E. Boufford & E. W. Wood, 17303* (GA, NCU); FLOYD COUNTY, Marshall Forest, Rome, *H. R. DeSelm & L. Lepps 31393* (TENN); FULTON COUNTY, College Park, woods, *C. & D. P. Schallert 11080* (IDS, KANU); MURRAY COUNTY, Chattahoochee National Forest, Lake Conasauga Recreation Area, *H. G. DiGioia 143* (GA); RABUN COUNTY, near Tate City, *A. Cronquist 5549* (GA, GH, IND, MICH, MO, NY, PH, SMU, UC, US, WS); STEPHENS COUNTY, N of Toccoa, SW of Yonah Lake, *D. E. Boufford & E. W. Wood 16820* (NCU, UNCC, VSC); TOWNS COUNTY, N-facing ravine at Unicoi Gap, *W. H. Duncan 22373* (GA); UNION COUNTY, 3 mi. W of Vogel State Park, *J. W. Hardin 251* (GA, MICH). ILLINOIS: ALEXANDER COUNTY, Horseshoe Island, *G. N. Jones 12044* (ILL, NY, SMU); CASS COUNTY, Virginia, *F. C. Gates 61* (MICH); CHAMPAIGN COUNTY, 15 mi. W of Urbana, *G. N. Jones 16436* (ILL, MO, TEX); CHRISTIAN COUNTY, damp woods, *without collector in 1862* (LSU); COOK COUNTY, 3 mi. SE of Barrington, *N. R. Bennett 8512* (CM); CUMBERLAND COUNTY, 2 mi. W of Toledo, *J. C. Myers in 1950* (WVA); DEKALB COUNTY, no further data, *E. K. Abbott in July* (CAS); DUPAGE COUNTY, Naperville Park, *L. Umbach 6683* (MIN, NY, WS); FAYETTE COUNTY, NE of St. Elmo, *L. O'Dell 597* (ILL); FORD COUNTY, 0.5 mi. N of Roberts, *O. A. Seng 64* (ILL); GALLATIN COUNTY, Shawneetown, *E. J. Palmer 15497* (MO); HAMILTON COUNTY, Delafield Bottoms, *N. Tracy in 1972* (SIU); HANCOCK COUNTY, Hancock Township, Crooked Creek, *F. C. Gates 10035* (MO); IRIQUOIS COUNTY, E of Milford, *H. E. Ahles 3230* (ILL); JACKSON COUNTY, Grand Tower, *H. A. Gleason 2509* (GH); JERSEY COUNTY, Marquette Park, *P. Jacobs 14* (ILL); JO DAVIESS COUNTY, SW of Galena, *H. E. Ahles 4392* (ILL); JOHNSON COUNTY, 3 mi. S of Vienna, *J. White 1181* (NLU); KANE COUNTY, 7 mi. W of Aurora, *C. & E. Erlanson 1544* (NA); KANKAKEE COUNTY, SE side of Aroma Park, *D. Seigler & K. Becker 4936* (ILL); KNOX COUNTY, 4.5 mi. S of



Victoria, *J. C. Solomon* 949 (KNOX, KYO, MO); LAKE COUNTY, 3 mi. S of Lake Zurich on U.S. 12, *D. Keil* 532 (ASU); LASALLE COUNTY, Starved Rock, Illinois State Park, *F. H. Thone* 12 (MO); LAWRENCE COUNTY, ca. 1 mi. W of Lawrenceville, *N. C. Henderson* 66-634 (CAS, FSU, KANU); LEE COUNTY, Amboy, *J. B. Long* 450 (ILL); MACON COUNTY, woods near Decatur, *H. A. Gleason* 9151 (NY, WIS); MACOUPIN COUNTY, Rock House, *J. White* 83 (SIU); MASON COUNTY, SE of Easton, *D. Seigler* 7709 (ILL); MCDONOUGH COUNTY, near Lamoine R., *R. M. Meyers* 4617 (NLU); MCHENRY COUNTY, Algonquin, *W. A. Nason in 1978* (ILL); MCLEAN COUNTY, 1.5 mi. N of McLean, *R. T. Calef* 528 (ILL); MONROE COUNTY, NE $\frac{1}{4}$ , Sec. 13, T3S, R10W, *C. Bollwinkel* 291 (SIU); MOULTRIE COUNTY, 2 mi. SE of Bethany, *R. P. Wunderlin & W. Chapman* 329 (SIU); OGLE COUNTY, 6 mi. E of Polo, White Pine State Forest, *J. A. Steyermark* 40719 (MO); PEORIA COUNTY, Kickapoo Valley, Horseshoe Bottom, *V. H. Chase* 3149 (DS, IA, ILL, MICH, MIN, MO, NY, PAC, PH, POM, UC, US, WTU); PIATT COUNTY, near Monticello, *G. N. Jones* 18946 (ILL); PIKE COUNTY, Shepherd, Mississippi bottoms, *J. Davis* 4066 (MO); POPE COUNTY, Allen Hollow, *W. M. Bailey & J. R. Swayne* 2515 (NCU); PUTNAM COUNTY, Putnam, *V. H. Chase* 11245 (DUL, ILL); RICHLAND COUNTY, County Line Road, *R. Ridgway* 3106 (PH, POM); SANGAMON COUNTY, 0.4 mi. S of the Sangamon R. on route I-55, *D. E. Boufford et al.* (G, MO, P); ST. CLAIR COUNTY, 4 mi. N of Millstadt, *D. Rhodes* 729 (LTU); STARK COUNTY, Sec. 14, T12N, R6E, adjacent Spoon R., *R. Riggins* 202 (UTC); TAZEWELL COUNTY, E Peoria, *V. H. Chase* 11243 (DUL); UNION COUNTY, Panther's Den, *R. R. MacMahon* 484 (MIN); VERMILION COUNTY, 5 mi. S of Potomac, *H. M. Franklin in 1949* (ILL); WABASH COUNTY, near Friendsville, *J. Schneck in 1879* (ILL); WASHINGTON COUNTY, Posin Road woods, *D. Windler* 548 (SIU); WHITESIDE COUNTY, Sterling, Sinnissippi Park, *V. H. Chase* 12914 (DAO, DS); WILL COUNTY, 2 mi. E of Braidwood, *Z. Vytanovych* 4167 (UT); WINNEBAGO COUNTY, 2 mi. E of Harrison, *R. B. Anthony in 1935* (WIS). INDIANA: ADAMS COUNTY, 3.5 mi. W of Decatur, *C. C. Deam* 40880 (IND); ALLEN COUNTY, along Cedar Creek, *C. C. Deam* 14368 (IND); BLACKFORD COUNTY, ca. 2 mi. NE of Harford City, *C. C. Deam* 61 (IND); BROWN COUNTY, Nashville, *J. Wright in 1892* (MIN, NDA); CARROLL COUNTY, ca. 7 mi. NE of Delphi, *C. C. Deam* 17776 (IND); CASS COUNTY, Wabash River, 1 mi. above Georgetown, *R. C. Friesner* 8840 (GA, UT); CLARK COUNTY, ca. 3 mi. NW of Henryville, *C. C. Deam* 6940 (IND); CLAY COUNTY, ca. 2 mi. E of Harmony, *R. C. Friesner* 21718 (SMU); CRAWFORD COUNTY, ca. 1 mi. NE of Leavenworth, *C. C. Deam* 20412 (IND); DAVIESS COUNTY, 5 mi. NW of Odon, *C. C. Deam* 25621 (IND); DEARBORN COUNTY, 3.5 mi. SE of St. John's Church, *R. C. Friesner* 23448 (DAO, WIS); DEKALB COUNTY, ca. 2 mi. SE of Hamilton, *C. C. Deam* 44932 (IND); DELAWARE COUNTY, ca. 2 mi. NW of Daleville, *R. C. Friesner* 24273 (DUKE, LTU, OKL); DUBOIS COUNTY, ca. 1 mi. N of Jasper, *C. C. Deam* 11571 (IND); ELKHART COUNTY, 3 mi. SE of New Paris, *C. C. Deam* 50419 (IND); FAYETTE COUNTY, ca. 1 mi. SE of Alpine, *C. C. Deam* 47300 (IND); FLOYD COUNTY, ca. 5 mi. SW of New Albany, *C. C. Deam* 27921 (IND); FOUNTAIN COUNTY, Porlland Arch, *D. Siegler* 7634 (OKL); FULTON COUNTY, ca. 8 mi. SW of Rochester, *C. C. Deam* 64982 (IND); GIBSON COUNTY, ca. 6 mi. W of Patoka, *C. C. Deam* 13356 (IND); GRANT COUNTY, E side of Dollar Lake, *Potzger* 7019 (ND); GREENE COUNTY, ca. 5 mi. NE of Bloomfield, *C. C. Deam* 44734 (CM, IND, UARK); HANCOCK COUNTY, near New Palestine, *Mrs. C. C. Deam* 9094 (IND); HARRISON COUNTY, ca. 3 mi. SE of Elisabeth, *C. C. Deam* 16387 (IND); HENDRICKS COUNTY, ca. 1.5 mi. W of Camby, *Mrs. C. C. Deam* 11479 (IND); HENRY COUNTY, E side of Road 3, 0.6 mi. S of Road 40, *R. C. Friesner* 24193 (SMU); HOWARD COUNTY, 3-4 mi. N and W of Kakoma, *C. Ek* 46 (US); HUNTINGTON COUNTY, Salamonie Township, *C. C. Deam* 2165 (IND); JACKSON COUNTY, 3 mi. SW of Brownstown, *R. Jackson* 169 (IND); JASPER COUNTY, Barkley Township, *W. Welch* 623 (ILL); Jay County, ca. 3.5 mi. NE of Pennville, *C. C. Deam* 45138 (IND); JEFFERSON COUNTY, Clifty Falls State Park, *C. C. Deam* 47500 (IND); JENNINGS COUNTY, ca. 0.5 mi. above Vernon, *C. C. Deam* 11307 (IND); KNOX COUNTY, 1 mi. SE of Emison, *S. McCoy* 4596 (DAO, UMO); KOSCIUSKO COUNTY, S of Warsaw, *F. Wann in 1917* (CU, PENN); LAGRANGE COUNTY, Wall Lake, along Ind. 120, *N. C. Henderson* 61-570 (FSU); LAKE COUNTY, 3.5 mi. W of Lowell, *C. C. Deam* 31621 (IND); LAPORTE COUNTY, 3 mi. NW of New Carlisle, *C. C. Deam* 31409 (IND); LAWRENCE COUNTY, woods S of A. Cumming's house, *P. G. Wible* 4550 (IND); MARION COUNTY, Indianapolis, 3700 block N Gladstone Ave., *R. C. Friesner* 8799 (CAS, FUGR, OKLA, RM, SMU, TRT, WS); MARSHALL COUNTY, near Lake Maxinuckee, *J. Scovell & H. Clark* 1274 (?) (US); MARTIN COUNTY, White R. ca. 1 mi. above Shoals, *C. C. Deam* 11426 (IND); MIAMI COUNTY, 3 mi. W of Bunker Hill, *C. M. Ek in 1942* (MO); MONROE COUNTY, 10 mi. SE of Bloomington, *R. C. Friesner* 3040 (ND); MONTGOMERY COUNTY, along Sugar Creek near the Shoals, *C. C. Deam* 9329 (IND); MORGAN COUNTY, 2 mi. S of Morgantown, *R. C. Friesner* 7581 (CAS, DUKE, OSC, PENN, POM, RM, SMU, TENN, TEX, TRT, UT, UTC, WVA); NOBLE COUNTY, E of Kendalville, *C. C. Deam* 5153 (IND); OHIO COUNTY, ca. 3 mi. SE of Milton, *C. C. Deam* 47406 (IND); OWEN COUNTY, 6.8 mi. SW of Whitehall, Green's Bluff, *S. I. Matsunami* 178 (NCU); PARKE COUNTY, Turkey Run State Park, *R. F. Daubenmire in 1929* (WS); PERRY COUNTY, ca. 3 mi. N of the mouth of Deer Creek, *C. C. Deam* 28517 (IND); PORTER COUNTY, Indiana Dunes State Park, along Dunes Creek, *H. R. Bennett* 7068

(OKL, W); POSEY COUNTY, Nash's Woods, *S. A. Cain in 1932* (TENN); PUTNAM COUNTY, ca. 20 mi. SW of Greencastle, Hoosier Highlands, *W. H. Welch 5939* (UC); RANDOLPH COUNTY, 2 mi. SW of Modoc, *C. C. Deam 41374* (IND); RIPLEY COUNTY, 1.5 mi. NW of Delaware P.O., *C. C. Deam 36997* (IND); RUSH COUNTY, 2 mi. W of Gowdy, *C. C. Deam 41413* (MT); ST. JOSEPH COUNTY, Notre Dame, *J. A. Nieuland 1873* (ND); SCOTT COUNTY, 2.5 mi. N of Lexington, *C. C. Deam 28014* (IND); SHELBY COUNTY, woods near Morristown, *Mrs. C. C. Deam 11335* (IND); SPENCER COUNTY, ca. 9 mi. N of Rockport, *C. C. Deam 25261* (IND); STEUBEN COUNTY, near Clear Lake, *C. C. Deam in 1904* (ISC, MO, US); TIPPECANOE COUNTY, Ross Biological Preserve, *C. W. Miller 207* (DUKE); UNION COUNTY, 1.6 mi. E of Fayette-Union County line at Road 44, *R. C. Friesner 20623* (MICH, MO, OKL, TEX); VANDENBURGH COUNTY, 5 mi. E of Evansville, *C. C. Deam 16779* (IND); VIGO COUNTY, Terre Haute, *B. Evermann in 1884* (US); WABASH COUNTY, ca. 4 mi. W of LaFontaine, *C. C. Deam 50315* (IND); WARREN COUNTY, 1.25 mi. S of Rainsville, *C. C. Deam 50625* (IND); WARRICK COUNTY, 2 mi. N of Yankee town, *C. C. Deam 25327* (MT); WASHINGTON COUNTY, home woodlot, *J. S. Brooks in 1929* (IND); WAYNE COUNTY, Williamsburg, *F. W. Pennell 9831* (MIN); WELLS COUNTY, Kemp's Woods in Harrison Township, *C. C. Deam 2327* (MIN); WHITE COUNTY, just W of Buffalo, *C. C. Deam 39406* (IND); WHITLEY COUNTY, ca. 3 mi. E of Columbia City, *C. C. Deam 45033* (UARK). IOWA: ADAIR COUNTY, no further data, *J. E. Gow in 1900* (IA); ALLAMAKEE COUNTY, Hanover Township, *W. L. Tolstead in 1933* (COLO); APPANOOSE COUNTY, NW of Unionville, *B. Shimck in 1902* (ISC); BLACK HAWK COUNTY, Cedar Heights, *M. Burk 618* (ILL); BOONE COUNTY, Des Moines River bottom, *D. Isely 4741* (OKLA, US); BREMER COUNTY, near Waverly, *B. Shimck in 1898* (ISC); BUCHANAN COUNTY, Winthrop, *M. Murley 1492* (ISC); CASS COUNTY, Cass Township, Sec. 15, SW $\frac{1}{4}$ , *C. P. Malone 371* (ISC); CEDAR COUNTY, 1 mi. SE of Rochester, *M. Fay 666* (OSC, UC); CERRO GORDO COUNTY, Mason City, SW side of Buffalo Slough, *B. Shimck in 1920* (IA); CHEROKEE COUNTY, Stiles property, *J. L. Carter 3095* (IA); CHICKASAW COUNTY, no further data, *W. D. Spiker in 1926* (ISC); CLARKE COUNTY, Osceola, *F. C. S. in 1892* (ISC); CLAY COUNTY, Little Sioux River in Wanata State Park, *A. Hayden 4000* (ISC); CLAYTON COUNTY, near McGregor, *G. J. Goodman 2700* (OKL, TEX); CLINTON COUNTY, Liberty Township, *T. S. Cooperrider 1805* (IA); DALLAS COUNTY, Des Moines Township, Des Moines R., *T. van Brugger 686* (IA); DAVIS COUNTY, Lick Creek Township, *A. Hayden 9170* (GH, ISC); DECATUR COUNTY, below spillway of lake in Nine Eagles State Park, *T. van Brugger 2577* (IA, SDU); DELAWARE COUNTY, Union Township, *M. D. Rickey 851* (IA); DES MOINES COUNTY, Flint Hills State Park, *C. L. Gilly 2819* (ISC); DICKINSON COUNTY, 2 mi. W of Milford, Little Sioux R., *R. F. Thorne 13218* (IA, UC); DUBUQUE COUNTY, White Pine Hollow State Forest Reserve, *R. F. Thorne 30115* (IA); EMMET COUNTY, High Lakewoods, *B. O. Wolden 886* (ISC); FAYETTE COUNTY, 4 mi. NE of West Union, "Dutton's Cave," *M. Murley 272* (ISC); FRANKLIN COUNTY, 6 mi. S of Hampton, *P. H. Monson 3637* (ISC); FREMONT COUNTY, Sidney, *L. Pammel 402* (GH, ISC); GRUNDY COUNTY, 3.5 mi. W of Grundy Center, *L. J. Eilers 4036* (IA); GUTHRIE COUNTY, 5 mi. NE of Guthrie Center, *P. H. Monson 3327* (ISC); HAMILTON COUNTY, 2 mi. S of Webster City, *P. H. Monson 852* (ISC); HANCOCK COUNTY, edge of acid bog, *R. D. Albertson 171-60* (ISC); HARDIN COUNTY, 4 mi. E of Hubbard, *P. H. Monson 2747* (ISC); HENRY COUNTY, Mt. Pleasant, *J. H. Mills 712* (IA); HOWARD COUNTY, Turkey R. area, *L. J. Eilers 2151* (IA); HUMBOLT COUNTY, N side of Hwy 222 at W edge of Livermore, *P. H. Monson 3544* (ISC); IOWA COUNTY, N of Middle Amana, *W. Easterly 548* (ARIZ, IA, MT); JACKSON COUNTY, Bellevue State Park, *T. S. Cooperrider 2042* (MIN); JASPER COUNTY, Rock Creek Township, Victor Grange, *T. van Brugger 602* (DAO); JEFFERSON COUNTY, Center Township, behind Golf Course, *C. L. Gilly & M. McDonald 917* (ISC); JOHNSON COUNTY, Newport, *D. Corwin 55* (IDS); JONES COUNTY, Hale Township, Sec. 24, NW $\frac{1}{4}$ , *T. S. Cooperrider 1854* (MIN, NCU); LEE COUNTY, Sec. 29, SE $\frac{1}{4}$ , T66N, R6W, *R. Davidson 2289* (IA, US); LINN COUNTY, Cedar Rapids, *G. H. Berry in 1913* (IA); LOUISA COUNTY, Muscatine Island, *P. C. Myers in 1897* (IA); MADISON COUNTY, SW of Winterset Backbone, *B. Shimek in 1919* (ISC); MAHASKA COUNTY, bluffs 14 mi. SW of Oskaloosa, *D. W. Augustine 333a* (ISC, OKL); MARION COUNTY, Summit Township, Sec. 29, *T. van Brugger 2472* (ASU); MITCHELL COUNTY, S of St. Ansgar along the Cedar River, *B. Shimek in 1930* (ISC); MONONA COUNTY, Preparation Canyon State Park, *J. L. Carter 3173* (IA); MUSCATINE COUNTY, 8 mi. NW of Muscatine, *B. Shimek in 1925* (MIN); PAGE COUNTY, 5 mi. SW of Clarinda, *M. J. Fay 5729* (IA); POLK COUNTY, Margo Frankell State Park, *T. van Brugger 2388* (IA, SMU); POWESHIEK COUNTY, Warren Township, Sec. 5, *M. J. Huston 51* (GRI); STORY COUNTY, Ames, *L. H. Pammel & C. R. Ball 24* (GH, ISC, MO, NY, US); TAMA COUNTY, Gladbrook, *L. H. Pammel in 1929* (ISC); TAYLOR COUNTY, Lake of Three Fires State Park, *M. J. Fay 3966* (IA, UC); UNION COUNTY, Creston, *T. L. Andrews in 1880-1882* (ISC); VAN BUREN COUNTY,  $\frac{1}{4}$  mi. NNW of Hillsboro, *R. A. Davidson 356* (IA, NCU, SMU); WARREN COUNTY, Lake Ahquabi State Park, *T. van Brugger 980* (IA); WASHINGTON COUNTY, 1 mi. N of Kalona, English River Township, *B. L. Wagenknecht 591* (IA); WEBSTER COUNTY, Otho Township, Woodman's Hollow State Park, *M. Lelong M128* (ISC); WINNEBAGO COUNTY, Forest City Park, *P. H. Monson 3713* (ISC); WINNESHIEK COUNTY, Calmar, *W. L. Tolstead in 1933* (MO); WORTH

COUNTY, Hanlantown, *L. H. Pammel in 1902* (ISC); WRIGHT COUNTY, Rowan, *K. Whited 2733* (OSC). KANSAS: ATCHISON COUNTY, 4 mi. N, 2 mi. W of Atchison, *S. Stephens 57926* (KANU); BOURBON COUNTY, Devon, on Berlin Hill, *Z. Thompson 674* (KANU); CHEROKEE COUNTY, no further data, *G. L. Clothier & H. N. Whitford in 1897* (KSC); COFFEY COUNTY, 5.2 mi. N of Aliceville, *L. Magrath 6166* (KANU); DONIPHAN COUNTY, 0.7 mi. SE of the Kansas-Nebraska line on K7, *L. Magrath 5906* (KANU); DOUGLAS COUNTY, 1.5 mi. E and 2 mi. S of Baldwin City, *J. E. Bare 2350* (KANU, MASS, VDB); FRANKLIN COUNTY, 1 mi. E, 3 mi. S of Homewood, *S. Stephens & R. Brooks 32717* (ASU, KANU, NLU, VDB); GREENWOOD COUNTY, Eureka, *A. S. Hitchcock in 1892* (KSC); JEFFERSON COUNTY, N of New Perry, *J. E. Bare 2541a* (KANU, NY); JOHNSON COUNTY, Olathe, *A. S. Hitchcock in 1892* (KSC); LEAVENWORTH COUNTY, 3 mi. W, 1.5 mi. N of Tonganoxie, *S. Stephens 58888* (KANU); LINN COUNTY, 2 mi. N of Trading Post, *R. McGregor 10498* (KANU); LYON COUNTY, 1 mi. N and 1 mi. W of Reading, *J. Wilson 9100* (?); MARSHALL COUNTY, no further data, *G. L. Clothier & H. N. Whitford in 1897* (KSC); MIAMI COUNTY, no further data, *G. L. Clothier & H. N. Whitford in 1897* (KSC); NEMAHA COUNTY, no further data, *A. S. Hitchcock in 1896* (KSC); NEOSHO COUNTY, 6 mi. E of Chanute along Big Creek, *W. W. Holland 145* (KSC); POTTAWATOMIE COUNTY, Pottawatomie State Lake no. 1, *W. Barker 4256* (GH, KANU, UARK); RILEY COUNTY, woods, *J. B. S. Norton 690* (GH, KSC, MO, NMU, NY, RM, US); SHAWNEE COUNTY, 1 mi. S of Elmont, *L. Volle 321* (KANU); WOODSON COUNTY, Grassland, creek banks, *W. Harr in 1930* (KANU); WYANDOTTE COUNTY, 1 mi. S, 1 mi. E of Piper, *G. Seiler & R. Brooks 5346* (KANU). KENTUCKY: ANDERSON COUNTY, Wildcat Road, *M. E. Wharton 10062* (KY); BARREN COUNTY, 3 mi. SW of Glasgow, *H. A. Gleason 8857* (NY); BATH COUNTY, Olympian Springs, *M. E. Wharton 2539a* (KY, MICH, MO); BELL COUNTY, Pine Mt. State Park, Bear Wallow Gap, *E. J. Carr in 1965* (KY); BOYLE COUNTY, 0.75 mi. W of Junction City, *M. E. Wharton 2961* (MICH); BREATHITT COUNTY, Robinson Forest, *D. M. Smith 1634* (KY, NCU); BULLITT COUNTY, Bernheim Forest, *C. R. Gunn 92* (NCU); CALDWELL COUNTY, Pennyrite State Park, *G. E. Hunter & D. F. Austin 1723* (MUR, NCU); CALLOWAY COUNTY, 2 mi. N of junction hwy 121 & 1386 on 1386, W Fork Clarks R., *V. A. Funk 667* (MO); CARLISLE COUNTY, near junction of Laketon Road and railroad tracks, *G. E. Hunter & J. L. Gentry 3220* (MUR); CASEY COUNTY, 9 mi. N of Liberty, *M. E. Wharton 4721* (KY, MO, NY); CLARK COUNTY, near Oil Springs, *M. E. Wharton 4614* (DHL, KY, MICH, NY); CRITTENDEN COUNTY, 1/4 mi. SE of Crayne, *G. E. Hunter & D. F. Austin 1943* (MUR, NCU); EDMONSON COUNTY, Mammoth Cave National Park, Doyle Valley, *B. B. McInteer 569* (WIS); ESTILL COUNTY, 2.5 mi. SE of Red River on Winchester-Irvine Road, *M. E. Wharton 2997* (KY, WIS); FAYETTE COUNTY, Boone Creek near the Kentucky River, *M. E. Wharton 9034* (DHL); FLEMING COUNTY, 4 mi. SE of Plummer's Mill, *M. E. Wharton 4513* (MICH, TENN); FRANKLIN COUNTY, near Rocky Branch, *M. E. Wharton 10938* (KY); FULTON COUNTY, near U.S. 45, SW of Fulton, *B. B. McInteer 1760* (KY); GARRARD COUNTY, White Oak Creek, *M. E. Wharton 10099* (KY); GRANT COUNTY, 1.6 mi. from junction of Fort Mill Road and Ky. 36, *E. M. & E. T. Browne, Jr. 4634* (MEM); GRAVES COUNTY, 2 mi. SE of Mayfield Woods, *D. O'Dell & D. Windler 871* (SIU); GRAYSON COUNTY, U.S. 62, 8 mi. E of junction of U.S. 62 & Ky. 105 in Caneyville, *E. M. & E. T. Browne, Jr. 7541* (KY, MEM); GREENUP COUNTY, 3 mi. from Boyd County line, "Big Woods," *L. Smith et al. 3579* (US); HARLAN COUNTY, Big Black Mt., *T. H. Kearney, Jr. 212* (CAN, ISC, MIN, NY, OS, US); HENDERSON COUNTY, Audubon Park, *G. E. Hunter & D. F. Austin 2284* (MUR, NCU); HENRY COUNTY, 0.6 mi. N of Union Church, 2 mi. N of U.S. 421, *J. L. Gentry, Jr. 408* (KY, MEM, NCU, NY); HOPKINS COUNTY, Ky. 70, 2.8 mi. E of junction of Ky. 70 & Ky. 109 at Beulah, *E. M. & E. T. Browne, Jr. 7737* (KY, MEM, NCU); JEFFERSON COUNTY, Goose Creek, *Davies in 1944* (DHL); JOHNSON COUNTY, Little Mine Fork of Paint Creek, 1 mi. N of Hargis, *D. Keil & M. Roberts 3947* (OS); LETCHER COUNTY, near U.S. 119 on N side of Pine Mt., *B. B. McInteer 1912* (KY); LEWIS COUNTY, 2 mi. SW of Petersville, *M. E. Wharton 5459* (KY); LIVINGSTON COUNTY, Hwy 133 N to bridge crossing Deer Creek, *R. Athey 232* (MEM); LYON COUNTY, Kentucky Woodlands National Wildlife Refuge, *R. L. Buck 204* (BHO); MADISON COUNTY, Cowbell Lake, *J. Grossman 128* (KY, LL); MARION COUNTY, 2.75 mi. SE of New Market, *M. E. Wharton 4665* (MICH, NCSC, NY); MARSHALL COUNTY, 0.6 mi. from Calloway County line on rte 94E, *R. Athey 1851* (MEM); MCCracken COUNTY, Riedland Community, *R. Athey 668* (MEM); MCCREARY COUNTY, Daniel Boone National Forest, Great Meadows Campground, *E. M. & E. T. Browne, Jr. 72E8,6* (MEM); MCLEAN COUNTY, Bates Knob near Semway, *J. Conrad 1671* (KY); MENIFEE COUNTY, Skidmore Creek, *H. L. Setser 614* (KY); MERCER COUNTY, near Oregon, *M. E. Wharton 10198* (KY); MONTGOMERY COUNTY, 1.75 mi. SE of Jeffersonville, *M. E. Wharton 2844* (MICH); OLDHAM COUNTY, Shiloh Lane at Harrods Creek, *J. J. Mathews 371* (DHL); POWELL COUNTY, near Nada Tunnel, *P. D. Higgins 1562* (DHL); ROCKCASTLE COUNTY, near Copper Creek, *M. E. Wharton 2636* (MICH, NCSC, TENN); ROWAN COUNTY, S of Triplett, *M. E. Wharton 6501* (DHL, KY); SIMPSON COUNTY, Robey's Swamp near Franklin, *G. E. Hunter et al. 2830* (MUR, NCU); TRIGG COUNTY, 0.25 mi. SE of marker 7E4, *W. H. Ellis 01365* (ISC, NLU, TENN); UNION COUNTY, near McCotrey school, *H. Shacklette 382* (NY); WARREN COUNTY, 3 km N of Hadley, Clifty

Hollow, *J. Conrad* 230 (MO). LOUISIANA: BIENVILLE PARISH, SE of Bryceland, 1 mi. E of La. 9, *R. D. Thomas et al.* 49449 (DUR, NLU, UARK); EAST FELICIANA PARISH, Jackson, *W. M. Carpenter* (1811–1848) (NO); WEST FELICIANA PARISH, Alexander's Creek N of hwy 35, *C. Brown* 7235 (LSU), ca. 15 mi. N of St. Rosemound, *Curry et al.* 524 (LSU), between Tunica & Turnbull, gorges N of La. 66, *R. D. Thomas* 49261 (NLU). MAINE: ANDROSCOGGIN COUNTY, South Poland, *K. Furbish* in 1897 (NEBC); AROOSTOOK COUNTY, Mt. Horse, *G. R. Cooley & A. S. Pease* 6848 (NCU); CUMBERLAND COUNTY, Cumberland, *E. Chamberlain* in 1901 (NEBC); FRANKLIN COUNTY, Farmington, Sandy R. near rte 4 & village of Fairbanks, *G. B. Roszbach* 6383 (ACAD, NCU, WVW); HANCOCK COUNTY, Orland, *H. Atkins* (NEBC); KENNEBEC COUNTY, Gardiner and vicinity, *N. C. Fassett* in 1935 (WIS); KNOX COUNTY, above SW shore of Megunticook Lake, rte 105, Camden, *G. B. Roszbach* 6680 (WVW); OXFORD COUNTY, Paris, near Snow's Falls, *A. Norton* 19130 (NEBC), Gilead, *A. S. Pease* 17428 (NEBC), Canton, *J. Parlin* 2059 (GH, NEBC); PENOBSCOT COUNTY, Orono, Sutton woodlot, *E. C. & E. B. Ogden* 2370 (DAO, OKL, TEX, US), South Dixmont, summit of Mt. Harris, *G. Roszbach* 223? (ACAD); SAGADAHOC COUNTY, ski area in Topsham, *R. M. Downs* 4705 (NCSC); SOMERSET COUNTY, Skowhegan, *R. C. Bean* in 1934 (NEBC), Moscow, Austin Stream, *J. Collins & E. Chamberlain* in 1902 (NEBC); WALDO COUNTY, Freedom, Beaver Ridge, *G. B. Roszbach* 1810 (ACAD, WVW); YORK COUNTY, South Berwick, The Gorge, *O. M. Neal, Jr.* in 1935 (MIN). MARYLAND: ALLEGHENY COUNTY, ca. 1 mi. SE of Westernport, *R. M. Downs* 6980 (NCU); ANNE ARUNDEL COUNTY, 0.25 mi. N of Priests Bridge, near Bowie, *E. H. Walker & F. R. Fosberg* 2846 (GA); BALTIMORE COUNTY, woods, 2103 Bluemont Road, *W. E. Brumback* 76-22 (BALT); CALVERT COUNTY, Scientist's Cliffs, Parker Creek, *F. C. Seymour* 17288 (MO); CARROLL COUNTY, 3 mi. N of Eldersburg on rte 32, *T. D. Misotti* 76-004 (BALT); CECIL COUNTY, E of North East, *F. Hermann* 3411 (NA); FREDERICK COUNTY, Catoclin Mt. Park, *C. J. Hickey II* 64 (BALT, NCU); GARRETT COUNTY, Bubbling Spring, Washington Camp, *J. A. Nieuwland* in 1933 (ND); HARFORD COUNTY, Rocks, Deer Creek State Park, *D. L. Windler & Keenan* 3117 (BALT, BRY, FSU, GAS, H, KANU, LTU, MASS, NCU, OSC, PAC, SIU, TENN, VSC, WILLI); HOWARD COUNTY, Grace Chemical Co. woods, rte 32, *J. Engh* in 1964 (MARY); KENT COUNTY, Lloyd's Creek Spit, *P. Gladu* in 1965 (MARY); MONTGOMERY COUNTY, 3 mi. ESE of Rockville, *F. R. Fosberg* 19012 (NA); PRINCE GEORGES COUNTY, Suitland, *C. P. Smith* 3193 (DS); QUEEN ANNES COUNTY, near Chestertown, *E. Vanatte* in 1904 (PH); TALBOT COUNTY, Arcadia, near Easton, *F. Shreve* in 1902 (ARIZ); WASHINGTON COUNTY, Round Top, ca. 3 mi. SW of Hancock, *R. M. Downs* 1131 (NCU). MASSACHUSETTS: BARNSTABLE COUNTY, Spring Hill, Sandwich, *M. L. Fernald & B. Long* 18851 (NEBC, PH); BERKSHIRE COUNTY, Beckett, *G. N. & F. F. Jones* 17214 (CM, IA, MIN, MO, NY), Lanesboro, *J. R. Churchill* in 1915 (MO); BRISTOL COUNTY, Easton, *C. Blomberg* in 1901 (NEBC); DUKES COUNTY, Martha's Vineyard, Menemsha, Chilmark, *F. C. Seymour* 10035 (DAO, DUKE, SMU); ESSEX COUNTY, Boxford, *L. E. Richardson* in 1962 (MO); FRANKLIN COUNTY, Colrain, *A. S. Goodale* 61131 (OKL); HAMPDEN COUNTY, Wilbraham, Mt. Wilbraham, *F. C. Seymour* 684 (DUKE, MO, NY, SMU, WIS); HAMPSHIRE COUNTY, Hatfield, Horse Mountain, *H. E. Ahles* 77723 (ASU, BALT, CM, DS, GA, H, ISC, KANU, KYO, MA, MASS, MEM, MIN, MISS, NDA, NHA, NLU, OKLA, PAC, SMU, TENN, UBC, UMO, VPI, WTU, WVA); MIDDLESEX COUNTY, Winchester, *E. Rouleau, L. B. & C. B. Smith, Pl. Exsic. Grayanae* 1374 (B, BH, CAN, CAS, COLO, CU, DAO, DS, DUKE, GA, GH, IA, ILL, IND, ISC, KANU, KY, LL, LTU, MASS, MICH, MIN, MO, MT, NA, NCU, NHA, NO, NY, NYS, OKL, OKLA, OSC, PAC, PENN, PH, POM, RM, SMU, TENN, TEX, TNS, TRT, UARK, UBC, UC, US, UTC, WIS, WS, WVA); NANTUCKET COUNTY, Wawwinet, *E. Prediger* in 1969 (VDB); NORFOLK COUNTY, Stoughton, *S. F. Blake* 6488 (LL); PLYMOUTH COUNTY, Duxbury Beach, *H. St. John* 789 (NEBC); SUFFOLK COUNTY, Oak Island, *R. A. Ware* in 1906 (VDB); WORCESTER COUNTY, W of Camp Putnam, *P. H. Raven & O. Solbrig* 16505 (KYO, MHA, MO); Lunenburg, *B. N. Gates* 26233 (NEBC). MICHIGAN: ALCONA COUNTY, ca. 1 mi. S of Curran, *E. G. Voss* 4675 (MICH); ALLEGAN COUNTY, W shore of Green Lake, *C. W. Bazuin* 3047 (MICH); ARENAC COUNTY, ca. 8.5 mi. N of Standish, *E. G. Voss* 4644 (MICH); BAROGA COUNTY, Ford Forestry Center, *E. A. Bourdo, Jr.* 28602 (H, NLU, W); BENZIE COUNTY, N side of Crystal Lake, *F. C. Gates* 20835 (KSC); BERRIEN COUNTY, Warren Woods, *C. Billington* in 1919 (MICH); BRANCH COUNTY, Bronson, *C. A. Brown* 2572 (WIS); CASS COUNTY, ca. 5 mi. SW of Edwardsburg, *E. G. Voss* 7534 (MICH); CHARLEVOIX COUNTY, ca. 9 mi. E of Boyne Falls, *E. G. Voss* 13487 (MICH); CHEBOYGAN COUNTY, Vincent Lake, *F. C. & M. T. Gates* 10670 (MO); CLINTON COUNTY, Essex Township, Sec. 10, T8N, R3W, *G. W. Parmelee* 2726 (TEX, VDB); DELTA COUNTY, Burnt Bluff, *F. Hermann* 6315 (MICH, NA, POM); EATON COUNTY, Hamlin Township, Sec. 12, T1N, R3W, *G. W. Parmelee* 2753 (TEX); EMMET COUNTY, Wycamp River woods, *F. C. Gates* 22241 (KSC, OKL, OKLA, UMO, WIS); GENESEE COUNTY, Flint, Glenwood Cemetery, *E. E. Sherff* in 1907 (POM); GRAND TRAVERSE COUNTY, ca. 6 mi. SE of Traverse City, *J. V. A. Dieterle* 1854 (CM, MICH); GRATIOT COUNTY, about Alma, *C. A. Davis* in 1892 (WS); HILLSDALE COUNTY, 7 mi. SE of Hillsdale, *E. G. Voss* 7453 (MICH); HOUGHTON COUNTY, E of Chassell, bank of Sturgeon, *R. C. Richards* 1288 (ACAD, IDS); INGHAM COUNTY, Michigan

State Univ. campus, Baker Woodlot, *W. D. Stevens 1617* (KYO); JACKSON COUNTY, Waterloo Township, Sec. 15, T1S, R2E, *G. W. Parmelee 673* (FSU); KALAMAZOO COUNTY, Kellogg Forest, *MSU Botany 203-S Class 47* (OKL); KENT COUNTY, Courtland Township, Sec. 24, T9N, R10W, *G. W. Parmelee 1292* (VDB); LAPEER COUNTY, ca. 6 mi. SW of Metamora, *E. G. Voss 7291* (MICH); LIVINGSTON COUNTY, Greenoak Township, Island Lake State Recreation Area, *D. Lynch in 1947* (SMU); MACKINAC COUNTY, St. Ignace, 1.5 mi. N of hwy U.S. 2, *H. H. Bartlett & C. D. Richards 362* (DAO, MT, TRT); MANISTEE COUNTY, ca. 7.5 mi. E of Brethren, *E. G. Voss 11148* (MICH); MASON COUNTY, Riverton Township, ca. 3.5 mi. SW of Scottville, *E. G. Voss 11179* (MICH, TRT); MECOSTA COUNTY, ca. 2 mi. W of Big Rapids, *E. G. Voss 7598* (MICH); MENOMINEE COUNTY, Kinepoway Red Oak Stand no. 25, *G. Goff in 1964* (NCU); MONROE COUNTY, 4.5 mi. S of Milan, *B. Robertson 319* (MICH); MONTCALM COUNTY, ca. 6 mi. SW of Sheridan, *E. G. Voss 7588* (MICH); MONTMORENCY COUNTY, 3.5 mi. S of hwy 32, *R. Perdue 7104* (NA); MUSKEGON COUNTY, Dalton Township, *E. A. Bourdo, Jr. 121* (MICH); NEWAYGO COUNTY, shore of Kimball Lake, *C. W. Bazuin 3511* (MICH); OAKLAND COUNTY, Parkedale, *O. A. Farwell in 1914* (MICH, WIS); OCEANA COUNTY, Pentwater, *Miller in 1928* (GA); OSCEOLA COUNTY, 4 mi. WSW of Tustin, *E. G. Voss 14220* (MICH); ST. CLAIR COUNTY, Port Huron, *C. K. Dodge in 1896* (NCU, TENN); ST. JOSEPH COUNTY, Lockport Township, Sec. 34, T6S, R11W, *G. W. Parmelee 17211* (FSU, TEX); SANILAC COUNTY, near Shabonna, *E. G. Voss 7351* (MICH); SHIAWASSEE COUNTY, Owosso, *G. H. Hicks in 1889* (MIN); TUSCOLA COUNTY, ca. 1 mi. NW of Mayville, *E. G. Voss 7350* (MICH); VAN BUREN COUNTY, 3–4 mi. N of Paw Paw, *E. Shear, Jr. in 1921* (CU); WASHTENAW COUNTY, 0.75 mi. W of Scio, *F. J. Hermann 6280* (MICH, MIN, MO, NA, PH, POM, WIS); WAYNE COUNTY, Flat Rock, *O. Farwell 7450* (GH); WEXFORD COUNTY, ca. 8 mi. NW of Cadillac, *E. G. Voss 3284* (MICH). MINNESOTA: ANOKA COUNTY, Carlos Avery Refuge, *R. J. Benson 93* (MIN); BECKER COUNTY, Detroit Lakes, *O. Stevens in 1933* (OSC); BELTRAMI COUNTY, 4 mi. NW of Panemah, *J. W. Moore & N. L. Huff 19161* (DAO, MIN); BENTON COUNTY, 2 mi. SW of Foley, *J. W. Moore & N. L. Huff 18863* (MIN, RM, WVA); BLUE EARTH COUNTY, 3 mi. W of Mankato, *J. W. Moore 26764* (IA, MIN); BROWN COUNTY, Sleepy Eye, *E. P. Sheldon S1038* (MIN); CARVER COUNTY, Page Lake, *C. A. Ballard B757* (MIN); CASS COUNTY, Gulf Lake, Sandy Point, *A. Chandler 1559* (MO); CHISAGO COUNTY, Center City, *J. Sandberg 661* (ISC, US); CLAY COUNTY, Buffalo State Park, *O. A. Stevens in 1962* (NDA), 5 mi. S of Moorehead, Forest Stand no. 12, *W. J. Wanek 311* (NDA), along the Wild Rice River at Ulen, *J. W. Moore 23663* (MIN); CLEARWATER COUNTY, Itasca Park, Bear Point, *J. B. Moyle 940* (CU, DUL, MO, NY, POM, SMU, UC); CROW WING COUNTY, Garrison Township, E of Chandler Lake, *J. W. & M. F. Moore 261* (MIN); DOUGLAS COUNTY, 1 mi. NW of Evansville, *J. W. Moore 21320* (MIN, NDA); FARIBAULT COUNTY, Sec. 7, SW $\frac{1}{4}$  of the SE $\frac{1}{4}$ , T101N, R27W, *T. Morley 970* (MIN); GOODHUE COUNTY, along the Zumbro R., *W. L. Tolstead in 1933* (COLO); HENNEPIN COUNTY, Lake Minnetonka, N shore Brown's Bay, *H. A. Hedman 34* (MIN); HOUSTON COUNTY, Crooked Creek, *W. A. Wheeler 270* (MIN); ITASCA COUNTY, Bowstring, *H. E. Stork in 1925* (GRI), ca. 30 mi. NW of Grand Rapids, *G. A. Wheeler & P. N. Glaser 1857* (DUR, NCU); KANABEC COUNTY, NE shore of Knife Lake, *J. W. Moore & D. L. Jacobs 14971* (ISC, MIN); KANDIYOHI COUNTY, Willmar, *W. D. Frost in 1892* (CU, ISC, MIN, OKL, UC, UTC, WIS); LAKE COUNTY, Manomin Lake portage, *C. Ahlgren 2822* (DUL, TRT), Rice Bay area of Basswood Island, *O. Lakela et al. 18066* (TRT); LAKE OF THE WOODS COUNTY, vicinity of Fort St. Charles, Magnuson Island, *J. W. & M. F. Moore 11270* (MIN, TRT, US), Lake of the Woods, Four Mile Bay, *J. W. & M. F. Moore 12208* (BRY, MIN, SMU); MEEKER COUNTY, near Dassel, old Trousdail Farm, *H. L. Dale in 1925* (DS); MILLE LACS COUNTY, Milaca, *E. P. Sheldon in 1892* (MIN, ORE, RM, US, WIS, WS); MORRISON COUNTY, Center Valley, *J. W. Moore & N. L. Huff 18001* (DAO, MIN, NDA); NICOLLET COUNTY, Courtland, *C. A. Ballard B1022* (MIN); NORMAN COUNTY, 3 mi. E, 1.3 mi. N of Syre, *G. B. Ownbey & F. Ownbey 2279* (KE, MIN); OTTER TAIL COUNTY, Lake Lida, *E. P. Sheldon S3769* (MIN); PINE COUNTY, near the NE corner of St. Croix State Park, *J. W. Moore & N. L. Huff 18102* (MIN); POLK COUNTY, 4 mi. S of Bygland, Forest Stand no. 30, *W. J. Wanek 447* (NDA); POPE COUNTY, Glenwood, *B. C. Taylor T886* (MIN); RAMSEY COUNTY, St. Paul, *T. S. Roberts in 1884* (MIN); RED LAKE COUNTY, woods of Clearwater R., *O. A. Stevens & D. R. Moir in 1960* (NDA); REDWOOD COUNTY, Redwood Falls, *E. P. Sheldon S940* (MIN); RICE COUNTY, Nerstrand Woods, *Linnaean Club, U. of Minn. 270* (MIN); ST. LOUIS COUNTY, Duluth, along Fischer Creek, Hunter's Hill, *O. Lakela 4736* (DUL, ISC, MIN, SMU, WIS, WS), Prairie Lake, SW corner of the county, *O. Lakela 7881* (DUL, MIN), Lake Kabetogoma, near Point Park Resort, *O. Lakela 9479* (DAO, DUL, MIN), Eureka, *H. Eggert in 1887* (RM); SCOTT COUNTY, Prior's Lake, *C. A. Ballard B493* (MIN); STEARNS COUNTY, Collegeville, *P. E. Kuehne in 1933* (DAO), St. Joseph, SBC woods, *Sister R. Westkaemper in 1966* (MIN); TRAVERSE COUNTY, Sec. 31, T126N, R48W, *R. P. Williams 2352* (NDA); WABASHA COUNTY, Lake City, (MIN 159745); WASECA COUNTY, E shore of Lake Elysian, *J. W. Moore & Y. T. Hsi 23473* (MIN); WINONA COUNTY, Winona, *G. W. Freiberg in 1912* (MO); WRIGHT COUNTY, 1 mi. NW of Annandale, *J. W. Moore & D. L. Jacobs 14619* (MIN). MISSISSIPPI: ADAMS COUNTY, 1.8 mi. S of junction U.S. hwy 61-84 at Natchez, *L. C. Temple 11225* (MISS); DESOTO COUNTY, ca. 1 mi. ESE of Walls, *S. McDaniel 11667* (GA, MO, VDB); LAFAYETTE

COUNTY, Taylor, *L. Boil in 1914* (MISS); PANOLA COUNTY, 6 mi. W of Batesville, Tallahatchie R., *J. D. Ray 6887* (CAS, GA, OKLA); TATE COUNTY, W end of Arkabutla Dam, *T. M. Pullen 66354* (MISS); WARREN COUNTY, 8 mi. N of Bovina, *T. H. Pullen 64606, 64612* (MISS); WILKINSON COUNTY, ca. 9 mi. W of Woodville, *K. Rogers 8402* (NCU, TENN, VDB). MISSOURI: ANDREW COUNTY, 3.5–4 mi. SE of Fillmore, *J. A. Steyermark 70002* (UARK); BARRY COUNTY, Eagle Rock, *B. Bush 38* (MO, US); BARTON COUNTY, 3 mi. NE of Milford, *E. J. Palmer 52893* (UMO); BOLLINGER COUNTY, 5 mi. W of Grassy, *J. A. Steyermark 14149* (MO); BOONE COUNTY, woods on prairie N of Columbia, *H. W. Rickett in 1929* (UMO); CAPE GIRARDEAU COUNTY, near Cape Girardeau, *E. J. Palmer 18009* (MO); CEDAR COUNTY, Bear Creek, *W. Trelease 341* (MO); CHRISTIAN COUNTY, 4 mi. SE of Chadwick, *J. A. Steyermark 23053* (MO); CLAY COUNTY, no further data, *B. F. Bush 12754* (MO, UMO, WIS); CLINTON COUNTY, ca. 6 mi. S of Cameron, *J. A. Steyermark 14917* (MO); DENT COUNTY, Montauk State Park, *R. D. Thomas et al. 9694* (NLU); DOUGLAS COUNTY, beside White R. and Mo. 14 at Twin Bridges, *R. D. Thomas et al. 15760* (NLU); FRANKLIN COUNTY, Meramec State Park, *J. M. Mason in 1938* (UMO); GREENE COUNTY, vicinity of Springfield, *P. C. Standley in 1905* (US); HARRISON COUNTY, 5–6 mi. N of Cainsville, *J. A. Steyermark 40313* (MO); HICKORY COUNTY, E of Jordan, along Little Niangua R., *J. A. Steyermark 13349* (MO, UMO); IRON COUNTY, Iron Mt., Lake, *J. H. Kellogg 1895* (MO); JACKSON COUNTY, Courtney, *B. F. Bush 7690* (GH, MIN, NY); JASPER COUNTY, Webb City, Lakeside Park, *E. J. Palmer 469* (MIN, MO); JEFFERSON COUNTY, 1 mi. N of Pevely on Marble Springs Road, *G. Davidse 3427* (MO); JOHNSON COUNTY, near Columbus, *E. J. Palmer 36726* (MO); LAWRENCE COUNTY, 3 mi. NE of Lawrenceburg, *E. J. Palmer 52380* (SIU, MO); LEWIS COUNTY, 0.5 mi. S of Monticello, *J. A. Steyermark 25649* (MO); LINCOLN COUNTY, Cuivre River State Park, *W. T. Kennell in 1970* (MO); LIVINGSTON COUNTY, NW of Chillicothe, *S. Sparling 997* (ISC); MARIES COUNTY, ca. 4 mi. E of Shantytown, *P. L. Redfearn 21668* (NCU); MARION COUNTY, Hannibal, Riverview Park, *J. Davis 9024* (DAO); MILLER COUNTY, between Sudheimes & Iberia, *J. A. Steyermark 13035* (MO); MORGAN COUNTY, Osage R. near mouth of Proctor Creek, *J. A. Steyermark 13164* (MO); NEWTON COUNTY, 3.5 mi. NW of Wentworth, near Haddock Spring, *E. J. Palmer 58002* (UMO); NODAWAY COUNTY, W of Clearmont, Nodaway R., *J. A. Steyermark 5877* (MO); OREGON COUNTY, ca. 3 mi. NW of New Liberty, *P. L. Redfearn 12734* (FSU, UMO, VDB); OZARK COUNTY, NE of Tecumseh, Althaea Springs, *R. D. Thomas et al. 31224* (NLU, TENN); PERRY COUNTY, 3 mi. N of Menfro, *J. A. Steyermark 14036* (MO); PHELPS COUNTY, Jerome, *J. H. Kellogg 122* (MO); PLATTE COUNTY, Farley, *B. F. Bush 11799* (MIN, MO, NY, SMU, UMO); POLK COUNTY, 0.5 mi. N of Burns, *J. A. Steyermark 13573* (MO, UMO); RALLS COUNTY, near New London, bluffs of Salt R., *E. J. Palmer & J. A. Steyermark 40719* (MO); REYNOLDS COUNTY, ca. 10 mi. SE of Redford, *J. A. Steyermark 14223* (MO); ST. GENEVIEVE COUNTY, Terre Bleue Creek, *W. Trelease 1039* (MO); ST. LOUIS CITY, *N. Riehl 116* (MO); ST. LOUIS COUNTY, Creve Couer Lake, *J. H. Kellogg in 1927* (MO); SALINE COUNTY, 5 mi. SW of Miami, Van Meter State Park, *J. A. Steyermark 20432* (MO); SHANNON COUNTY, vicinity of Jam-up Cave, *P. L. Redfearn et al. 824* (MO, NCU); STONE COUNTY, 1 mi. NW of Marmaros, *J. A. Steyermark 22619* (MO); TANEY COUNTY, 1.5–2 mi. N of Mincy, *J. A. Steyermark 5542* (MO); WARREN COUNTY, tributary to Lost Creek, *C. O. Marvin 422* (MO); WAYNE COUNTY, Williamsville, *C. T. in 1900* (UMO). NEBRASKA: BROWN COUNTY, Long Pine, *J. M. Bates in 1911* (MIN); CASS COUNTY, Wabash, *T. Williams in 1889* (US); CHERRY COUNTY, NE of Valentine at Niobrara National Wildlife Refuge, *S. P. Churchill 4494* (MO, NDA, NEB, NLU, NY); DODGE COUNTY, near Fremont, *C. Engberg in 1894* (NEB); DOUGLAS COUNTY, campus of Univ. of Nebraska at Omaha, *D. Sutherland 1865* (OMA); FRANKLIN COUNTY, streams and hillsides, *Hus-song 4697* (NEB); HALL COUNTY, along Platte River S of Grand Island, *R. Lemaire 2558* (NEB); HOOKER COUNTY, near the Forks of Dismal R., *P. A. Rydberg 1463* (GH, NY); NEMAHA COUNTY, Peru, *J. Winter 41* (US); OTOE COUNTY, Nebraska City, *J. Winter 76* (US); RICHARDSON COUNTY, Sec. 26, T1N, R18E, Rulo-White Cloud Road, *P. Shildneck C-6701* (NEB); SARPY COUNTY, near Gretna Fish Hatchery, *S. P. Churchill 6097* (KANU, MO, NDA, NEB, NLU); SHERIDEN COUNTY, Pishelville, *F. Clements 2766* (BH, GH, MIN, NEB, US); THOMAS COUNTY, near Plummer Ford, Dismal R., *P. A. Rydberg 1463* (H, NEB, NY, US); THURSTON COUNTY, 1.5 mi. E of hwy junction 73-94, Sec. 13, T25N, R9E, *S. P. Churchill 7912* (KANU, MO, NDA, NEB, NLU); WASHINGTON COUNTY, Neale Woods, *M. W. Antrim 56* (OMA). NEW HAMPSHIRE: CARROLL COUNTY, town of Wonalancet, Cold R., *L. K. Henry in 1971* (CM); CHESHIRE COUNTY, town of Surry, *D. E. Boufford 18860* (BM, CM, E, KYO, LD, MHA, MO, PE); COOS COUNTY, Shelburne, under cliffs of Crag, *W. Deane in 1917* (CU, MIN, SMU, TEX); GRAFTON COUNTY, Hanover, *H. Barss in 1910* (OSC); HILLSBOROUGH COUNTY, Wilton, *B. B. Lambert 13* (WS); MERRIMACK COUNTY, Hill, Murray Hill, *C. Bullard in 1932* (NEBC); ROCKINGHAM COUNTY, Derry, *C. F. Batchelder in 1913* (NEBC); STRAFFORD COUNTY, Madbury, Laton Farm, *A. R. Hodgdon 12977* (DAO, NHA); SULLIVAN COUNTY, Unity, *F. C. Seymour 20890* (MO, SMU). NEW JERSEY: BERGEN COUNTY, Fort Lee, *E. Magee in 1901* (GH); BURLINGTON COUNTY, Arneytown, *R. R. Driesbach 1545* (CM); CAMDEN COUNTY, NE of Haddonfield, *J. Fogg 7639* (CU, PH); CUMBERLAND COUNTY, Roadstown, Chestnut Run, *B. Long 41341* (PH); ESSEX COUNTY, Caldwell, *L. H. Lighthipe in 1917* (MO); GLOUCESTER COUNTY, Black-

wood, S Branch Turkey Creek, *B. Long 16847* (DS); HUNTERDON COUNTY, Kingwood Township, Wickecheoke Creek at Locktown, *M. L. Roberts 2491* (OS); MERCER COUNTY, Pennington, head of Shabakunk Creek, *B. Long 50136* (PH); MONMOUTH COUNTY, ca. 1 mi. NW of Cream Ridge, *B. Long 58552* (PH); MORRIS COUNTY, E shore of Lake Hopatcong, *P. H. Raven 16520* (KYO, MO); PASSAIC COUNTY, Passaic, *E. W. Berry in 1895* (NY); SALEM COUNTY, 1.5 mi. S of Sharptown, *J. Fogg 8840* (PH); SOMERSET COUNTY, Watchung, *H. N. Moldenke 1304* (DUKE, ILL, MO, PENN, PH); SUSSEX COUNTY, Beaver Lake, *K. K. Mackenzie 4326* (MO); UNION COUNTY, Watchung Reservation, *H. N. Moldenke 22455* (SMU); WARREN COUNTY, 0.5 mi. NE of Franksboro, *R. True 5726* (PENN). NEW YORK: ALBANY COUNTY, Rensselaerville, *G. R. Cooley 4771* (NO, VDB); ALLEGANY COUNTY, Allegany State Park, Tuna Valley, *W. Alexander in 1926* (US); BRONX COUNTY, Bronx Park, *G. Nash 315* (NY, PH); CATTARAUGUS COUNTY, Otto, *J. H. C. in 1881* (BH); CAYUGA COUNTY, Moravia, *C. Atwood in 1877* (CU); CHATAUQUA COUNTY, Lake Chatauqua, Bemis Point, *J. R. Churchill in 1896* (MO); CHEMUNG COUNTY, Elmira, S of Hoffman Nurseries, *L. H. Bailey 17316* (OKL, WTU); CHENANGO COUNTY, 5 mi. N of Norwich, *E. Davis 71* (NYS); CLINTON COUNTY, Valcour Island, *T. Baim & S. Smith 2993* (NYS); COLUMBIA COUNTY, Stuyvesant Falls, *R. McVaugh 1391* (PENN); CORTLAND COUNTY, S end of Chicago Bog, *A. Eames 6933* (CU, GH); DELAWARE COUNTY, Arkville, *E. Harvey in 1905* (PENN); DUTCHESS COUNTY, Hyde Park, Cardinal Road, *D. E. Boufford & H. E. Ahles 18836* (KYO, MO); ERIE COUNTY, Buffalo, Chautauqua, *M. Sawada 1030* (KYO, TNS); ESSEX COUNTY, woods near Minerva, *H. D. House 15402* (MO); GENESEE COUNTY, Oatka Creek valley, near Lime Rock, *W. A. Matthews 3147* (NCU); HAMILTON COUNTY, Indian Lake, *B. Lambert 82* (PH); HERKIMER COUNTY, along Graefenburg Res., *J. Haberer 2535* (GH); JEFFERSON COUNTY, Woodville, *H. D. House 19728* (NYS); KINGS COUNTY, Brooklyn, Prospect Park, *L. Stabler in 1886* (GH); LEWIS COUNTY, 2 mi. SW of Castorland, *N. Hotchkiss 2670* (NYS); MADISON COUNTY, Nelson, *F. Hunnewell 11711* (GH); MONROE COUNTY, 3 mi. W of Honeoye Falls, *W. A. Matthews 4360* (OKL, UC); NASSAU COUNTY, Albertson, Albertson Kettle-hole, *R. Abbott in 1952* (CU); NEW YORK COUNTY, Manhattan, Inwood Hell, *H. Dunslow in 1924* (NY); NIAGRA COUNTY, Lockport, *L. R. Moyer 2610* (MIN); ONEIDA COUNTY, woods bordering Delta Lake, *H. D. House 17911* (NYS); ONONDAGA COUNTY, De Witt, *C. A. Weatherby in 1915* (PH); ONTARIO COUNTY, Canandaigua, *E. J. Durand in 1891* (MIN); ORANGE COUNTY, Bear Mt. Area, *L. Y. Westra & L. S. Adderly 87* (KYO); ORLEANS COUNTY, 4 mi. W of Sweden Center, *F. R. Fosberg 48564* (US); OSWEGO COUNTY, Sandy Creek Township, *N. Hotchkiss 3153* (GH); OTSEGO COUNTY, Cooperstown, *F. Rane in 1919* (CU); QUEENS COUNTY, Alley Pond Park, *W. A. Weber 944* (COLO, ISC, OS); RENSSELAER COUNTY, margin of Glass Lake, *C. Brown 486* (LSU); RICHMOND COUNTY, Staten Island, Richmond, *O. Reich in 1906* (CU); ROCKLAND COUNTY, Ramapo Township, *J. Lehr 222* (NY); ST. LAWRENCE COUNTY, Canton, *O. Phelps 715* (CU, GH), Long Sault Lake, *E. Ogden et al. 54116* (NYS); SARATOGA COUNTY, Saratoga Lake, *H. D. House 26661* (POM); SCHOHARIE COUNTY, 2 mi. N of North Blenheim on hwy 30, *E. Haber 663* (TRT); STEUBEN COUNTY, W side of Waneta Lake, *R. Clausen 1370* (CU); SENECA COUNTY, Ovid, *J. Chickering in 1858* (US); SUFFOLK COUNTY, Long Island, Orient, *W. Ferguson 3891* (NY); SULLIVAN COUNTY, Wortsboro, *H. Eggert in 1873* (MO); TIOGA COUNTY, ca. 3 mi. SW of Owego on hwy 30, *E. Haber 646* (TRT); TOMPKINS COUNTY, near Blue Lake, *B. Maguire 6552* (POM, UTC, WS); ULSTER COUNTY, Marlboro, *J. Barnhart 154* (NY); WARREN COUNTY, Northwest Bay on Lake George, *H. D. House 30119* (TEX); WASHINGTON COUNTY, Pilot Knob, Lake George, *H. D. House 28188* (TEX); WAYNE COUNTY, Savannah, Crusoe Prairie, *A. Wright & L. Griscom 10506* (CU); WESTCHESTER COUNTY, North Tarrytown, *J. Barnhart 1492* (NY); YATES COUNTY, Dresden, *W. S. Phillips 218* (ARIZ). NORTH CAROLINA: ALLEGHENY COUNTY, woodlands at junction of county routes 1405 & 1406, *S. W. Leonard et al. 1862* (ARIZ, B, BAL, BRY, CLEMS, DS, FUGR, KE, MONTU, NCU, NHA, NLU, UNCC, UTC, WCUH); ASHE COUNTY, Bluff Mountain, *G. E. Tucker 2931* (SMU, VDB); AVERY COUNTY, 1.3 mi. S of Linville on N.C. 105, *T. L. Mellichamp 413* (UNCC); BERTIE COUNTY, 3 mi. S of Merry Hill, *D. S. Correll 1963* (DUKE, NA); BUNCOMBE COUNTY, Biltmore, deep woods, *Biltmore Herb. 1968b* (GH, MICH, MIN, MO, NCSC, NCU, NY, NYS, OS, PENN, TUR, US, VT, W); BURKE COUNTY, Linville Gorge Camp at end of Wagon Road, *E. J. Alexander in 1923* (NCU); CABARRUS COUNTY, Egg Rock woods, *T. Daggy 4181* (NCU); CHEROKEE COUNTY, 2 mi. E of Andrews, *H. J. Oosting 34620* (DUKE); CRAVEN COUNTY, Croatan National Forest, Island Creek, *E. D. Cappel & R. K. Godfrey 137* (NCSC, UC); DAVIDSON COUNTY, 2.5 mi. W of Churchland, Boone's Cave, *A. E. Radford 12877* (NCU, UC); DURHAM COUNTY, ca. 2 mi. N of Weaver, tributary of Little R., *H. E. Ahles 58016* (NCU); FORSYTH COUNTY, Winston-Salem, *P. O. Shallert 324* (MO, NCU, OKL, UTC); GRAHAM COUNTY, Appalachian Trail, 0.25 mi. S of Stecoah Gap, *A. Jackson & D. Sather 002* (FUGR); GUILFORD COUNTY, tributary of Reedy Fork Creek near Summerfield, *L. Melvin in 1955* (NCU); HAYWOOD COUNTY, vicinity of Eagle's Nest near Waynesville, *P. C. Standley 5450* (US); HENDERSON COUNTY, Fraser Hollow-Lanning Creek, *D. Pittillo 436* (KY, OSC); HERTFORD COUNTY, Deep Swamp Branch, N of Lloyds Crossroads, *H. E. Ahles & J. A. Duke 45921* (NCU); IREDELL COUNTY, ca. 2.5 mi. S of Cool Spring off county road 2316, *M. G. Lelong 5927* (NLU); JACKSON COUNTY, 3 mi. NW of Glenville, Tuckasegee Falls, *L. Anderson 1498* (PH); JONES

COUNTY, 5 mi. NE of Pollocksville, *M. N. Sears C426* (NLU); MACON COUNTY, 12 mi. W of Franklin, *W. B. Fox 4005* (BHO, NCSC, SMU, TENN); MADISON COUNTY, 4 mi. W of Hot Springs on U.S. 25-70, then 2.2 mi. S on Shut-In Creek Road, *H. E. Ahles & J. A. Duke 46466* (NCU, VPI); MARTIN COUNTY, near Conoho Creek 4.3 mi. NW of Williamston, *A. E. Radford 35284* (NCU, TENN, WVA); MCDOWELL COUNTY, Blue Ridge Parkway between Buck Creek Gap and Gillespie Gap, *J. H. Beaman 31* (NCSC); MECKLENBURG COUNTY, E of Mt. Holly-Huntersville Road, *J. F. Matthews & J. Hannon in 1972* (UNCC); MITCHELL COUNTY, 1.4 mi. NE of Hawk, *H. E. Ahles & J. A. Duke 47207* (GAS, NCU, UBC); ORANGE COUNTY, along creek below Mason Farm, *W. C. Coker in 1941* (NCU); PERQUIMANS COUNTY, 3 mi. N of Beach Spring, *A. E. Radford 5469* (MIN, NCU, PAC, PENN); PITT COUNTY, 1.2 mi. N of Grimesland, *A. E. Radford 35027* (MIN, NCU, RSA, SIU); POLK COUNTY, 4 mi. W of Tryon, *E. H. Walker 3462* (NCU, US); ROCKINGHAM COUNTY, Dan River near NC 14, S of Leaksville, *A. E. Radford 13670* (FSU, GA, GH, NCU, VDB); STOKES COUNTY, 2.2 mi. W of Harts Store, *A. E. Radford 37876* (COLO, NCU, OKLA); SURRY COUNTY, Pilot Mt., *H. R. Totten in 1935* (NCU); SWAIN COUNTY, Nantahala Gorge, 1 mi. S of Talc Mt., *A. E. Radford & J. G. Haesloop 7236* (NCU); TRANSYLVANIA COUNTY, along Coontree Creek Trail 1 mi. from U.S. 276, *T. L. Mellichamp 854* (UNCC); WAKE COUNTY, W. B. Umstead State Park, *G. P. Sawyer, Jr. & H. E. Ahles 1454* (NCU); WARREN COUNTY, Poplar Mount, *W. D. Seaman 3457* (NCU); WATAUGA COUNTY, 2.3 mi. SW of Bethel, *H. E. Ahles & J. A. Duke 43869* (NCU); WILKES COUNTY, 5 mi. E of Moravian Falls, *A. E. Radford 15242* (NCU); YANCEY COUNTY, NC 197 near Little Cane River Gap, *A. E. Radford 45055* (ASU, CM, COLO, FSU, GA, GAS, GH, H, IND, ISC, KANU, KY, LL, MIN, NCU, NDA, NY, OKLA, OSC, PAC, RSA, SIU, SMU, TENN, UARK, UBC, UC, VDB, VPI, WIS, WVA). NORTH DAKOTA: BARNES COUNTY, Kathryn, *N. F. Bergman 994* (NDA, OKL, POM); BENSON COUNTY, Pleasant Lake, *J. Lunell in 1912* (NY, SDU, US); CASS COUNTY, Fargo, *N. F. Bergman 2318* (MIN, MO, NDA, SNU); GRIGGS COUNTY, 5.5 mi. N, 1 mi. W of Binford, Red Willow Lake, *G. E. Larson 3640* (NDA); MORTON COUNTY, Huff, *O. A. Stevens in 1954* (NDA); PEMBINA COUNTY, Cavalier, *O. A. Stevens 2134* (CAN, DAO, MIN, NDA, NLU, NY, UC, US); RANSOM COUNTY, Little Yellowstone Park, *G. Seiler 2174* (KANU, MO, NDA); RICHLAND COUNTY, Leonard, *O. E. Stevens 284* (DAO, GA, MIN, MT, NDA, NY, OKL, SMU, UC, WIS); WALSH COUNTY, 1 mi. N, 3 mi. W of Park River, *G. E. Larson 3482* (KANU, NDA). OHIO: ADAMS COUNTY, Mineral Springs, *W. A. Kellerman in 1900* (OS); ASHLAND COUNTY, Jackson Township, 4 mi. SE of Sullivan, *G. T. Jones 69-7-23-817* (FSU); ASHTABULA COUNTY, Windsor Township, Wisell Road, 0.5 mi. S of U.S. rte 322, *L. W. Tandy 654* (VDB); ATHENS COUNTY, Athens Township, *H. Moore 1517* (BHO); AUGLAIZE COUNTY, St. Mary's, *A. Wetzstein in 1896* (OS); BELMONT COUNTY, Barnesville, *E. E. Laughlin in 1910* (OS); BROWN COUNTY, Sardinia, *W. A. Kellerman in 1900* (OS); BUTLER COUNTY, Oxford, *L. O. Overholts in 1910* (MO); CARROLL COUNTY, Washington Township, intersection county rte 14 & twp rte 260, *A. W. Cusick 8215* (KE); CHAMPAIGN COUNTY, rte 68 N of Springfield, *L. D. Cribben 248* (BHO, OKL); CLARK COUNTY, Springfield, *F. Davidson in 1885* (OSC); CLINTON COUNTY, New Antioch, *J. S. Vandervort in 1892* (OS); COLUMBIANA COUNTY, Butler Township, SW $\frac{1}{4}$  Sec. 20, *T. S. Cooperrider 6436* (KE); COSHOCTON COUNTY, North Appalachian Experimental Watershed, near Coshocton, *H. N. Moldenke 13138* (CM, NCSC, ND, OS, OSC, VDB); CRAWFORD COUNTY, Bucyrus Township, Wyandot Road, *A. W. Cusick 10264* (KE); CUYAHOGA COUNTY, NW of Oakwood, *J. F. Reilly 69* (KE); DARKE COUNTY, S of Versailles, *L. Camp & C. Weishaupt in 1955* (OS); DEFIANCE COUNTY, Washington Township, Scott Road, W of U.S. rte 127, *A. W. Cusick 12067* (KE); DELAWARE COUNTY, near tile works, *R. Crane 2952* (FSU, SMU, TRT); ERIE COUNTY, by Green Road, 1.5 mi. SE of Birmingham, *G. T. Jones 67-6-22-554* (BHO); FAIRFIELD COUNTY, Wahkeena Nature Preserve, *L. R. Noblick 419* (OS); FAYETTE COUNTY, Madison Mills, *E. D. Coberly & J. P. Song in 1901* (OS); FRANKLIN COUNTY, Alton-Darby Creek Road and Cole Road, *D. Keil 9332* (NLU, OS, VDB); FULTON COUNTY, Delta, *M. G. Aumend in 1892* (OS); GALLIA COUNTY, Raccoon Township, 0.5 mi. W of Tycon Lake, *G. M. Silberhorn 2756* (KE); GEAUGA COUNTY, Chardon Township, 3 mi. W of Chardon at Stebbins Gulch, *W. D. Hawver 61* (KE); GREENE COUNTY, John Bryant State Park, Yellow Springs, *D. Demaree 11437* (DS, MIN, NY, OS, SMU, UC, US); HAMILTON COUNTY, College Hill, *W. H. Aikeu in 1897* (OS); HANCOCK COUNTY, Blanchard Township, along Ottawa Creek, *A. W. Cusick 12009* (KE); HARDIN COUNTY, Jackson Township, ca. 1 mi. W, 0.5 mi. S of Forest, *C. Weishaupt in 1957* (OS); HENRY COUNTY, Harrison Township, adjacent to Hoy Cemetery, *A. W. Cusick 11855* (KE); HIGHLAND COUNTY, Brush Township, *F. Bartley in 1932* (BHO); HOCKING COUNTY, Little Rocky, E of Gibisonville, *J. D. & W. A. Westendahl 741* (BHO); HOLMES COUNTY, Killbuck Township, above Killbuck Creek, *T. S. Cooperrider 8169* (KE); HURON COUNTY, NE corner of Wakeman Township, *G. T. Jones in 1964* (KE); JACKSON COUNTY, Lake Alma State Park, *D. E. O'Dell 768* (BHO); JEFFERSON COUNTY, Island Creek Township, Granater Farm, *A. W. Cusick 8192* (KE); KNOX COUNTY, Jefferson Township, Mohican R., *P. L. Pusey 1155* (KE); LAKE COUNTY, Mentor, marsh of Wilson Street circle, *L. W. Tandy 679* (VDB); LAWRENCE COUNTY, Washington Township, N part of township, *C. Weishaupt in 1956* (OS); LICKING COUNTY, St. Albans Township, ca. 1 mi. N, 0.5 mi. E of Alexandria, *C. Weishaupt in 1957* (OS); LOGAN COUNTY, Union



Township, above Ruby Lake, *A. W. Cusick 13394* (KE); LORAIN COUNTY, Brownhelm Township, Chance Creek ravine, *T. S. Cooperrider & E. Herrick 7211* (KE); LUCAS COUNTY, oak openings, *R. E. Shanks in 1937* (OS); MADISON COUNTY, London, *Mrs. K. D. Sharp s.n.* (OS); MAHONING COUNTY, Green Township, W of Egypt Road, between rte 165 and Columbiana Co. line, *C. F. Chuey 797* (BHO); MEDINA COUNTY, Liverpool Township, SE of Valley City, *G. T. Jones 73-6-24-662* (TENN); MEIGS COUNTY, Forked Run State Park, Area 1, *J. D. Westendahl 63-177* (BHO); MONROE COUNTY, Summit Township, rte 78, 0.25 mi. E of Twp rte 41, *A. W. Cusick 9392* (KE); MONTGOMERY COUNTY, Dayton, *H. Saske in 1894* (OS); MORGAN COUNTY, Deerfield Township, NW¼, Sec. 3, *G. M. Silberhorn 1742* (KE); NOBLE COUNTY, Sharon Township, *W. A. Kellerman et al. in 1896* (OS); OTTAWA COUNTY, Put-in-Bay, *R. B. Clarkson in 1958* (WVA); PICKAWAY COUNTY, woods, *R. R. Dreisbach 2610* (MICH); PIKE COUNTY, Road S of Omega, *G. S. Crowl in 1938* (OS); PORTAGE COUNTY, 0.3 mi. S of the Geauga Co. line on rte 306, *D. E. Boufford 18819* (BM, CM, DS, E, G, K, KYO, LD, MHA, MO, NCU, PE, SHIN); PREBLE COUNTY, Hueston's woods N of Oxford, *E. B. in 1934* (DAO); Putnam County, Union Township, Sec. 16, *C. Weishaupt in 1960* (OS); RICHLAND COUNTY, Mansfield, *C. Wilkinson 3363* (BHO, CM, CU, DUKE, NMC, OKL, OS, RM, WIS); ROSS COUNTY, Mt. Logan near Chillicothe, *G. W. Hall 448* (BHO); SANDUSKY COUNTY, Sandusky-Riley Township, *C. Weishaupt in 1956* (OS); SCIOTO COUNTY, Shawnee State Forest, Friendship, Camp Gordon, C.C.C., *D. Demaree 10758* (CM, DS, GH, MIN, MO, OS, PH, UC, US, WIS); SENECA COUNTY, Thompson Township, 3 mi. W of Flat Rock, *G. T. Jones 69-7-9-703* (KE); SHELBY COUNTY, Botkins, *S. E. Harlacher in 1905* (OS); STARK COUNTY, Lake township, NE¼, Sec. 19, *J. E. Mann 859* (KE); SUMMIT COUNTY, SW of Everett, Bath Township, *G. T. Jones 73-7-10-769* (OS); TRUMBULL COUNTY, Casey's Spring along Mill Creek, *D. E. Boufford 18821* (CM, K, KYO, MHA, MO, NCU); TUSCARAWAS COUNTY, Wayne Township, 2 mi. N of Dundee, *B. Andreas 194* (KE); VAN WERT COUNTY, Ridge Township, *M. B. Overholt in 1940* (OS); VINTON COUNTY, Zaleski State Forest, King Hollow Trail, *L. V. Mingrone 406* (BHO, NLU); WASHINGTON COUNTY, Lawrence Township, near junction of rte 26 & road 25, *G. M. Silberhorn 1942* (KE); WAYNE COUNTY, Milton Township, intersection of State rte 604 & County rte 44, *A. W. Cusick 2688* (KE); WILLIAMS COUNTY, Brady Township, Shilling Farm, *A. W. Cusick 13661* (KE); WOOD COUNTY, Liberty Township, Sec. 21, *R. E. Shanks in 1937* (OS). OKLAHOMA: CADDO COUNTY, near Hinton, Devil's Canyon, *G. W. Stevens 938* (DS, GH, ILL, MIN, MO, NY, OKL, OKLA, US); CHEROKEE COUNTY, 0.5 mi. S of junction State hwy 10 on Chewey Road, *J. & C. Taylor 24767* (DUR), Eagle's Bluff, 12.2 mi. NE of Tahlequah on State 10, *C. S. Wallis 798* (OKLA); LEFLORE COUNTY, ca. 5.5 mi. NE of Big Cedar, N facing side of Rish Mt., *J. & C. Taylor 24653* (DUR); OTTAWA COUNTY, 5.5 mi. E of Miami on State 10, valley of a creek on Spring R., *C. S. Wallis 7322* (BH, GA, GH, KANU, NCU, NO, OKL, OKLA, SMU, TEX, UARK, UC). PENNSYLVANIA: ADAMS COUNTY, 1 mi. W of Heidlersburg, *H. I. Kennedy 700* (WVA); ALLEGHENY COUNTY, Pittsburgh, *W. C. Grimm 75* (CM); ARMSTRONG COUNTY, N side of the village of Baum, *D. E. Boufford 18824* (BM, KYO, MHA, MO); BEAVER COUNTY, woods along Beaver-Conway Road, *L. K. Henry 999* (NLU); BEDFORD COUNTY, W rim, Wolf Swamp Watershed, *H. Duppsstadt in 1970* (WVA); BERKS COUNTY, Oley Furnace, S slope of Sheep Hill, *H. Wilkins 2887* (ND); BLAIR COUNTY, 3.4 mi. SE of Williamsburg, *L. K. Henry in 1957* (CM); BRADFORD COUNTY, *E. Bartram in 1913* (PH); BUCKS COUNTY, Argus, *W. Benner in 1908* (ORE); BUTLER COUNTY, McBride, *W. E. Buker in 1963* (CM); CAMBRIA COUNTY, 0.25 mi. NE of Nicktown, *H. Kline in 1951* (CM); CAMERON COUNTY, Miller, *O. E. Jennings in 1904* (CM); CENTRE COUNTY, 3 mi. SE of Philipsburg, *L. K. Henry in 1941* (CM); CHESTER COUNTY, 2 mi. E of Eagle, *L. K. Henry in 1967* (CM); CLARION COUNTY, Red Bank, *O. E. Jennings in 1904* (CM); CLEARFIELD COUNTY, E of Clearfield, *O. E. Jennings in 1908* (CM); CLINTON COUNTY, 2 mi. N of Gleason, *L. K. Henry in 1956* (CM); COLUMBIA COUNTY, near Lanbach Station, *H. Meredith in 1920* (PH); CRAWFORD COUNTY, 2 mi. NE of Geneva, *R. C. Leberman in 1963* (CM); CUMBERLAND COUNTY, 2.5 mi. SW of Huntsdale, *E. T. Wherry in 1961* (PENN); DAUPHIN COUNTY, Dauphin, *J. K. Small in 1888* (US); DELAWARE COUNTY, Crum Creek, *W. Stone 1489* (UTC); ELK COUNTY, Benezette Township, Dent's Run, *A. N. Rood & W. Simon 2729* (KE); ERIE COUNTY, Presque Isle, *W. R. Van Dersal 1857* (CM); FAYETTE COUNTY, 2.5 mi. NE of Summit, *E. H. McClelland in 1923* (CM); FRANKLIN COUNTY, Mount Alto Forest, *R. H. True 12* (CM); FULTON COUNTY, N Ft. Littleton interchange of the Pa. Turnpike, *W. E. Buker in 1969* (CM); GREENE COUNTY, 3 mi. SE of Ryerson, *L. K. Henry & W. E. Buker in 1954* (CM); HUNTINGDON COUNTY, 0.5 mi. S of Valley School, *W. F. Westerfeld 8942* (BALT); INDIANA COUNTY, 2 mi. S of Uniontown, along rte 580, *W. E. Buker in 1974* (CM); JEFFERSON COUNTY, Allen Mills, 3.6 mi. N of rte I-80 on rte 310, *D. E. Boufford 18828* (CM, KYO, MHA, MO, PE); JUNIATA COUNTY, 2 mi. NW of Oakland Mills, *H. A. Wahl et al. 13836* (PENN); LACKAWANA COUNTY, 0.5 mi. NW of Wallsville, *S. Blowenke 8069* (PENN); LANCASTER COUNTY, 1 mi. NE of Cocalico, *R. Schaeffer, Jr. 43580* (KANU); LAWRENCE COUNTY, 1 mi. W of Eastbrook, along Neshannock Creek, *L. K. Henry & F. H. Beer in 1950* (CM); LEBANON COUNTY, 3 mi. SW of Schaefferstown, *C. S. Keener 551* (CM); LEHIGH COUNTY, Bethlehem, Lehigh Mt., *J. A. Wolle, in 1841* (CM); LUZERNE COUNTY, 0.25 mi. NNW of Nescafeck, *S. Glowenke 2719* (PENN); LYCOMING COUNTY, Williamsport to Allenwood, *O.*

*E. Jennings* in 1908 (CM); MCKEAN COUNTY, 5 mi. N of Port Allegany, *L. K. Henry* in 1956 (CM); MERCER COUNTY, 8 mi. NW of Mercer, Shenango Reservoir, *L. K. Henry* in 1967 (CM); MIFFLIN COUNTY, 3 mi. NW of Milroy, *J. M. Fogg 15491* (PENN); MONROE COUNTY, near Bushkill, Little Bushkill Creek, *F. B. Buser 10807* (NLU); MONTGOMERY COUNTY, road to Mason's Dam, *V. Wismer 422* (MIN); MONTOUR COUNTY, 2.3 mi. NW of Danville, *Wade & Wade 1813* (PAC, PENN); NORTHAMPTON COUNTY, Easton, Chestnut Hill, *O. E. & G. K. Jennings* in 1920 (CM); NORTHUMBERLAND COUNTY, 0.75 mi. SE of Mandeta, *E. T. Wherry* in 1961 (PENN); PERRY COUNTY, 1.5 mi. NW of New Bloomfield, *J. W. & M. T. Adams 2083* (CU, MO); PHILADELPHIA COUNTY, near Philadelphia, *F. Ball* in 1881 (MO); PIKE COUNTY, near Milford, *R. Little* in 1941 (CM); POTTER COUNTY, near Ole Bull State Park along rte 144, *W. E. Buker* in 1965 (CM); SCHUYLKILL COUNTY, 0.25 mi. S of Schuylkill Haven, *P. R. Wagner 7453* (CM); SNYDER COUNTY, 3 mi. SW of Beversprings, *Wade & Wade 1418* (PENN, WIS); SOMERSET COUNTY, woods at Murdock, *L. K. Henry & D. Ross* in 1963 (CM); SULLIVAN COUNTY, Eaglesmere, *T. Githens* in 1945 (PENN); SUSQUEHANA COUNTY, 2 mi. NNW of Elkdale, *J. M. Fogg 12144* (PENN); UNION COUNTY, 4 mi. W of Turtleville, Shamokin Mt., *O. B. Reed* in 1949 (WVA); VENANGO COUNTY, 2.5 mi. NW of Reno, *L. F. Baltzell 5-90* (FSU); WARREN COUNTY, North Warren, *H. N. Moldenke 16599* (WVA); WASHINGTON COUNTY, 2.5 mi. from the County Fairgrounds near Washington, Andy Farm, *D. Wilson 28* (CM, WVA); WAYNE COUNTY, Waymart, Moosie Mt., *E. M. Gress et al.* in 1920 (CM); WESTMORELAND COUNTY, Rodney, 8 km W of the Donegal interchange on the Pa. Turnpike, *P. Busey 206* (MO); YORK COUNTY, 2 mi. W of Wellsville, *K. B. Hoover 3979* (NCU). RHODE ISLAND: NEWPORT COUNTY, Middletown, *M. Simmons* in 1898 (NEBC); PROVIDENCE COUNTY, near Diamond Hill, *E. J. Palmer 46761* (KY); WASHINGTON COUNTY, Hopkinton, N of Ashaway, *M. L. Fernald et al.* in 1919 (NEBC), Block Island, *R. Marles 96* (NEBC). SOUTH CAROLINA: DARLINGTON COUNTY, along E side of Lauther's Lake on Witherspoon Island, *B. E. Smith 599* (NCU); OCONEE COUNTY, Brasstown Creek, gorge below the confluence with Little Brasstown Creek, *D. E. Boufford & J. R. Massey 17014* (NCU, UNCC); PICKENS COUNTY, Eastatoe Creek ca. 1 mi. above where it crosses hwy 178, *C. L. Rodgers & G. Shiflet, Jr. 69408* (FUGR). SOUTH DAKOTA: BENNETT COUNTY, LaCroft, *S. S. Visher 2237* (SDU); CLAY COUNTY, Vermillion, *W. H. Over 15832* (RM); GRANT-ROBERTS COUNTIES, SW shore of Big Stone Lake, Scout Camp, *P. Johnson 99* (GH, IA, ISC, MICH, MO, MONTU, NY, TEX, UMO, WTU); LAWRENCE COUNTY, Whitewood, *W. H. Over 13883* (SDU); PENNINGTON COUNTY, near Dark Canyon, along Rapid Creek, *A. C. McIntosh 528* (RM, SDU); ROBERTS COUNTY, Big Stone Lake, 2 mi. E of Hartford Beach, *B. Boivin 13831* (DAO, SASK); TODD COUNTY, 10 mi. SW of Roseland, Ironwood Creek valley, *W. L. Tolstead 4-386* (ISC). TENNESSEE: ANDERSON COUNTY, Melton Hill Reservoir, S of Solway Bridge, *W. H. Ellis 28853* (GA, TENN); BLEDSOE COUNTY, vicinity of Low Gap, *R. E. Shanks et al. 4463* (TENN); BLOUNT COUNTY, Walland, *L. E. Wehmeyer 270* (MICH); CARROLL COUNTY, NE of McMinnville, *R. E. Shanks et al. 5110* (TENN); CARTER COUNTY, woods in Sinking Creek area, *J. Pearman* in 1955 (TENN); COFFEE COUNTY, Sinking Pond forest on AEDC land E of Tullahoma, *N. DeSelm et al.* in 1973 (TENN); CUMBERLAND COUNTY, Black Mt., *N. E. Mullens* in 1950 (FUGR); DAVIDSON COUNTY, 14.6 mi. from Peabody, *J. M. Shaver 8534* (SMU, TENN, VDB); FENTRESS COUNTY, S of Jamestown, rim of Buffalo Cove, *R. E. Shanks et al. 4058* (TENN); FRANKLIN COUNTY, N of Sherwood, *H. Eggert* in 1897 (MO); GRAINGER COUNTY, Lea Lakes, *A. J. Sharp & L. R. Hesler 1607* (ND, TENN, UMO); GREENE COUNTY, ca. 0.5 mi. N of the French Broad R. along Paint Creek, *D. E. Boufford et al. 18111* (MO); GRUNDY COUNTY, just S of Beersheba Springs, *Dr. & Mrs. A. J. Sharp et al. 43575* (NCU, NY, VDB); HAWKINS COUNTY, Stanley Valley, *J. Wolfe 18389* (TENN); HAYWOOD COUNTY, Forked Deer (P.O.), *S. M. Bain 45* (OS); HENRY COUNTY, 1.5 mi. NE of Jones Mill, C. Boyd Farm, *D. H. Webb* in 1974 (MUR); HICKMAN COUNTY, 1.5 mi. N of Nunnely, *R. Kral 53703* (VDB); HOUSTON COUNTY, 4 mi. SE of Tennessee Ridge, *A. Clebsch* in 1956 (NCU); KNOX COUNTY, Knoxville, Cherokee Bluffs, *H. M. Jennison* in 1928 (MO, OKL); LAUDERDALE COUNTY, creek bottom W of Halls, *A. J. Sharp et al. 7968* (TENN); LAWRENCE COUNTY, NW of St. Joseph, Ted Smith Farm, *A. J. Sharp et al. 18* (RSA, TENN); LOUDON COUNTY, near Martel, *G. Jones & F. Wargo 4106* (NY); MONTGOMERY COUNTY, U.S. 41W, just E of Clarksville, *J. M. Shaver 9253* (VDB); OBION COUNTY, ca. 2 mi. E of Lassiter Corner along State hwy 21, *D. H. Webb et al. 915* (TENN); ROANE COUNTY, Clinch River Breeder Reactor site, *S. F. Hale & F. E. Williamson 48784* (TENN); RUTHERFORD COUNTY, Snail Shell Cave, 1.9 mi. NE of Rockvale, *L. E. Franklin et al. 276* (VDB); SEVIER COUNTY, Great Smoky Mountains National Park, ca. 0.5 mi. beyond Sugarlands, *K. E. Rogers 43620* (TENN); SULLIVAN COUNTY, Piney Flats, *A. J. Sharp 22364* (TENN); SUMNER COUNTY, ca. 3 mi. S of Westmoreland, *R. Kral 56103* (VDB); UNICOI COUNTY, Tennessee-North Carolina state line along the Appalachian Trail, *D. Norris & D. Frodin 33072* (TENN); WASHINGTON COUNTY, Johnson City, Cherokee Mt., *N. McCarroll & A. J. Sharp 3838* (TENN); WAYNE COUNTY, Natchez Trace Parkway, *W. McDougall 1373* (US); WHITE COUNTY, N of Yankeetown, *A. J. Sharp et al. 11572* (TENN); WILLIAMSON COUNTY, Fernvale, ca. 3 mi. W, *E. Quartermann 5083* (VDB). VERMONT: ADDISON COUNTY, Bristol, *C. H. Knowlton* in 1937 (TENN); BENNINGTON COUNTY, Winhall, *E. T. & H. N. Moldenke 9957* (BH, CM, ILL, MO, NA, NY); CALEDONIA COUNTY,

Ryegate, rte 302, *F. C. Seymour 18952* (MO); CHITTENDEN COUNTY, Richmond, rte 2 near Bolton line, *F. C. Seymour 22344* (MO, SMU); ESSEX COUNTY, Concord, *A. S. Pease 28459* (NEBC); FRANKLIN COUNTY, Swanton, *C. H. Knowlton, Plantae Exsiccatae Grayanae 571*, distributed as *C. canadensis* (= *C. × intermedia* Ehrh.), see also under *C. × intermedia* (CAN, VT); GRAND ISLE COUNTY, Grand Isle, *C. H. Knowlton in 1935* (NEBC); ORANGE COUNTY, Bradford, Wright's Mt., *E. Sundell 1283* (ASU); ORLEANS COUNTY, Willoughby, Fern Cave, *A. Lorenz in 1898* (NEBC); RUTLAND COUNTY, Brandon, *D. L. Dutton in 1921* (CM, CU, MO); WASHINGTON COUNTY, Montpelier, *C. H. Knowlton in 1915* (NEBC); WINDHAM COUNTY, Vernon, *B. L. Robinson 111* (NEBC); WINDSOR COUNTY, Bethel, *L. M. Kutchka in 1946* (CM). VIRGINIA: ALBERMARLE COUNTY, Keene, *C. E. Stevens 1128* (FARM); ALEXANDRIA COUNTY, above Pimmitt's Run at Chain Bridge, *N. Hotchkiss 1425* (?); AMELIA COUNTY, no further data, *J. B. Lewis 127* (VPI); AMHERST COUNTY, Blue Ridge Parkway, Otter Creek Trail between Concession & Otter Lake, *R. S. Freer & D. Ochsner in 1965* (LYN, VPI); APPOMATTOX COUNTY, near Stonewall Creek on County road 613, *G. W. Ramsey et al. 6622* (LYN, NCU, VPI); ARLINGTON COUNTY, vicinity of Fort Scott, *C. O. Erlanson 192* (DAO); CITY OF ARLINGTON, *F. Blanchard in 1890* (MO); AUGUSTA COUNTY, trail from White Rock Gap on Blue Ridge Parkway to Sherando Campgrounds, *R. S. Freer & J. Rockwell 4222* (LYN, NCU, VPI, WILLI); BATH COUNTY, 7 mi. W of Warm Springs on Va. 39, *O. W. Gupton 4027* (NCU, UNCC, WCUH); BEDFORD COUNTY, SW of Visitor Center, Peaks of Otter, *R. S. Freer 2744* (GH, LYN, VPI); BLAND COUNTY, 3 mi. SE of Suiter, *R. Kral 10883* (NCU, SMU, VPI); BOTETOURT COUNTY, W slope of Flat Top Mt., *R. S. Freer 1638* (GH, LYN); BRUNSWICK COUNTY, (see synonymy under *C. lutetiana* subsp. *canadensis*); BUCHANAN COUNTY, open slope near Council, *A. M. Harvill 34540* (FARM); BUCKINGHAM COUNTY, N of Bat Creek, *A. M. Harvill 17141* (MO, NCU); CAMPBELL COUNTY, 4.5 mi. S of Lynchburg on rte 29, *G. S. Waggoner & W. F. Ruska 8262* (LYN); CAROLINE COUNTY, between Mount Creek & Rappahannock Academy, *T. Bradley & I. Miller 12343* (GMUF); CHARLES CITY COUNTY, Harrison Lake National Fish Hatchery, *D. M. E. Ware 4269* (NCU, WILLI); CHARLOTTE COUNTY, creek near Staunton R. on county road 746, just S of county road 750, *G. W. Ramsey et al. 9166* (LYN); CLARKE COUNTY, Blandy Experimental Farm, Boyce, *J. T. Baldwin 5223* (VPI); CULPEPPER COUNTY, N slope of Mt. Pony, *H. A. Allard 8961* (VPI); DICKENSON COUNTY, ca. 10 mi. S of Haysi, *R. Kral 13060* (VPI); DINWIDDIE COUNTY, E of Dinwiddie, *M. L. Fernald & B. Long 10750* (GH, PH); ESSEX COUNTY, Hunter Mill Campground, *Miller & Stanley in 1974* (GMUF); FAIRFAX COUNTY, between rte 698 and Wedderburn Road, *J. Joosten 41* (FARM); FAUQUIER COUNTY, 2 mi. N of Hopewell Gap, *H. A. Allard 1836* (CM, GH, MO, NY); FLOYD COUNTY, Floyd, *W. Lord 102* (LYN); FLUVANNA COUNTY, near E Fork Kent Branch, 75 yards from the junction with the Middle Fork, *G. M. Diggs, Jr. & D. Soltis 279* (WILLI); FRANKLIN COUNTY, junction of county roads 748 & 788, *G. W. Ramsey et al. 6712* (LYN, NLU); FREDERICK COUNTY, Star Tannery, *F. W. Hunnewell 12412* (VPI); GILES COUNTY, 3 mi. W of Eggleston, Buckeye Mt., *G. B. Straley 1140* (MO); GLOUCESTER COUNTY, Clay Bank, on Berg Farm, rte 616, *M. H. Berg 267* (BALT, FUGR, NCU); GRAYSON COUNTY, 1 mi. NE of Corners Rock, *A. M. Harvill et al. 33631* (FARM); GREENE COUNTY, Shenandoah National Park, vicinity of Pinefield Lean-to, *J. Ewan 17229* (DUKE, NO); HALIFAX COUNTY, 2 mi. S of Brookneal, Staunton R. on hwy 501, *G. W. Ramsey et al. 4150* (LYN, NCU, VPI); HENRY COUNTY, near Philpott, near Smith R., *C. E. Stevens 13242* (FARM); HIGHLAND COUNTY, ca. 4 mi. S of McDowell, W. Va., *K. A. Nicely 730* (NCSC, NCU, VPI); JAMES CITY COUNTY, College of William & Mary, N section of Squirrel Point, *A. Barars 257* (NCU, VDB); KING WILLIAM COUNTY, S of Epworth on rte 610, *T. Bradley 13107* (GMUF); LEE COUNTY, Lovelady Gap, *B. J. & A. M. Harvill 31818* (FARM); LOUDOUN COUNTY, Upperville, *F. W. Hunnewell 10675* (VPI); LUNENBURG COUNTY, N Meherrin R., approx. 1 mi. from intersection with county road 689, *G. W. Ramsey et al. 9487* (LYN); CITY OF LYNCHBURG, Blackwater Creek just E of Langhorne Road, *G. W. Ramsey 15742* (LYN); MADISON COUNTY, along Five Tower Road just off county road 649, *F. C. James 11420* (NCU); MATHEWS COUNTY, S of Soles, N End Branch, *E. T. Wherry & F. W. Pennell 12609* (MO, NY); MECKLENBURG COUNTY, W hillside of Meherrin R. valley of Va. 664, *W. D. Seaman 4150* (NCU); MIDDLESEX COUNTY, 0.1 mi. S of rte 618 and 1.5 mi. W of its intersection with rte 17, *E. Train 314* (WILLI); MONTGOMERY COUNTY, ca. 3 mi. W of Price's Fork, *R. Kral 14813* (VDB); NANSEMOND COUNTY, Suffolk, *H. A. Gleason 8601* (NY); NELSON COUNTY, Tye R. near intersection of county roads 662 & 739, *G. W. Ramsey et al. 9331* (LYN, NCU); NEW KENT COUNTY, just E of rte 30, 0.5 mi. from its junction with rte 168, *D. Soltis & G. Hammond 283* (BALT, NCU, WILLI); CITY OF NEWPORT NEWS, Fort Eustis, NE side of loop at end of Stillwell Street, *P. K. Appler & S. Godwin 680* (NCU, WILLI); NORFOLK COUNTY, near Ocean View, *T. Kearney 1468* (US); NORTHUMBERLAND COUNTY, near Wicomico Church, *C. E. Stevens 13696* (FARM); NOTTOWAY COUNTY, Crystal Lake near Nottoway, *B. J. & A. M. Harvill 21795* (FARM); PAGE COUNTY, Stony Man Mt., near Luray, *E. S. & Mrs. Steele 69* (MO, US); PATRICK COUNTY, along county road 704 on Smith R. at bridge, *G. W. Ramsey et al. 6780* (LYN, NCU); PITTSYLVANIA COUNTY, Staunton R. on hwy 29 across from Altavista, *G. W. Ramsey et al. 4848* (LYN, NCU); POWHATAN COUNTY, rte 614, 0.67 mi. E of rte 613, *C. M. Corcoran & G. M. Diggs, Jr. 850* (WILLI); PRINCE EDWARD COUNTY, county road 625, 1.25 mi. E of the county line,

*G. W. Ramsey et al.* 7833 (LYN, NCU); PRINCESS ANNE COUNTY, Little Neck, *M. L. Fernald & B. Long* 4069 (GH, PENN); PULASKI COUNTY, no further data, *H. B. Meredith in 1923* (POM); RAPPAHANOCK COUNTY, Shenandoah National Park, Buck Hollow Trail, *E. H. Walker* 2424 (US); ROANOKE COUNTY, 2.4 mi. S of Wabun, Poor Mt., *L. J. Uttal* 6568 (LYN, NCU, VPI); ROCKBRIDGE COUNTY, Short Hills, *R. S. Freer* 2675 (LYN, US, VPI); ROCKINGHAM COUNTY, George Washington National Forest, Hone Quarry, *G. F. Roe* 1138-B (WILLI); RUSSELL COUNTY, Beartown Mt., on Red Fork of Franklin Creek, *A. Shield in 1959* (VPI); SCOTT COUNTY, limestone bluff just S of Hill, *A. M. Harvill* 31800 (FARM); SHENANDOAH COUNTY, Little Fort, Peters Mill Run bog, *L. Artz in 1965* (VPI); SMYTH COUNTY, Va. 601, 2.1 mi. S of 16, *L. J. Uttal* 8878-B (AUA, BALT, LYN, VPI); SPOTSYLVANIA COUNTY, Fredericksburg, Fall Hill, *H. Iltis* 265 (SMU); STAFFORD COUNTY, 3 mi. E of Stafford, *A. M. Harvill & C. E. Stevens* 29212 (FARM); SURRY COUNTY, S side of College Run near road 634 bridge, *L. Musselman et al.* 4949 (ID, NCSC, NCU, NLU, VSC, WILLI); TAZEWELL COUNTY, ca. 9 mi. S of Tazewell, *R. Kral* 10938B (FSU, NCU, VDB); WARREN COUNTY, Shenandoah National Park, Fort Wyndham Rocks, *F. R. Fosberg* 45651 (US); WYTHE COUNTY, Lower Rocks, Reed Creek, *J. K. Small in 1892* (MO); YORK COUNTY, 200 yards W of bridge over Navy railroad on N side of Yorktown Parkway, *E. D. Salle & L. Kean* 314 (FUGR, WILLI). WEST VIRGINIA: BARBOUR COUNTY, 2 mi. S of Philippi, rte 250, *E. L. Core* 5955 (WVA); BERKELEY COUNTY, on Back Creek at rte 9, *E. L. Core* 5810 (WVA); BOONE COUNTY, Jarrell's Branch, *W. V. U. Botanical Expedition* 619 (WVA, WVW); BRAXTON COUNTY, Sugar Creek S of Gassaway, *F. J. Boggs in 1953* (WVA); BROOKE COUNTY, woods of Bethany College Farm, *J. S. Bonar in 1958* (WVA); CABELL COUNTY, Pleasant Valley, *F. A. Gilbert* 592 (CM, DUKE, GA, ILL, MICH, MIN, MO, MT, NHA, NY, OKL, PH, SMU, TENN, UMO, US, WIS); CALHOUN COUNTY, Pink, *R. Harris in 1933* (WVA); DODDRIDGE COUNTY, 3 mi. W of Ashley, *E. L. Core* 5563 (WVA); FAYETTE COUNTY, old logging area near Thayer, *W. N. Grafton & C. McGraw in 1972* (WVA); GRANT COUNTY, Difficult Creek, *F. Moreland in 1965* (WVA); GREENBRIER COUNTY, Cales Mt., *E. E. Smith & D. Cole in 1947* (WVA); HAMPSHIRE COUNTY, Capon Lake, *F. W. Hunnewell* 18193 (WVA); HANCOCK COUNTY, ca. 3 mi. from Weirton, *J. S. Bonar in 1958* (WVA); HARDY COUNTY, ca. 1.25 mi. E of Mathias, *L. W. Wilson in 1941* (WVA); HARRISON COUNTY, near Clarksburg, *W. J. Judy in 1934* (WVA); JACKSON COUNTY, Crow Summit, *J. R. Mckown in 1949* (WVA); JEFFERSON COUNTY, Harper's Ferry, *E. L. Greene in 1912* (NDG); KANAWHA COUNTY, woods back Harper's Ferry, *E. L. Greene in 1912* (NDG); KANAWHA COUNTY, woods back of Edgewood Golf Course, *L. Greenlee in 1934* (WVA); LEWIS COUNTY, E side of ridge above road to Orlando, *E. A. Bartholomew & D. Wilson in 1965* (WVA); MARION COUNTY, Valley Falls, *M. Sweeney in 1960* (WVA); MARSHALL COUNTY, 2 mi. W of Bellton, *E. L. Core* 5326 (WVA); MCDOWELL COUNTY, Panther State Forest, *D. J. Music in 1961* (WVA); MERCER COUNTY, Athens, *W. R. Boggess* 284 (SMU); MINERAL COUNTY, *M. Brown in 1951* (WVA); MINGO COUNTY, in forest near Birch, *E. E. Berkley* 952 (MO); MONONGALIA COUNTY, Hillman Boy Scout Reservation, *G. M. Silberhorn* 1131 (VDB); MORGAN COUNTY, 4 mi. S of Great Cacapon, *E. L. Core in 1937* (WVA); OHIO COUNTY, Wheeling, *G. Guttenberg in 1878* (CM); PENDLETON COUNTY, Spruce Knob, *W. A. Lunk in 1941* (WVA); POCAHONTAS COUNTY, 5 mi. SW of Cass, *R. B. & J. Clarkson* 634 (MAK); PRESTON COUNTY, Cathedral State Park, *M. Brown in 1964* (WVA); RALEIGH COUNTY, Rock Creek, *J. Jarrell in 1970* (WVA); RANDOLPH COUNTY, rte 33 just SE of Ellamore, *G. B. Rossbach* 1437 (CLEMS, WVA, WVW); RITCHIE COUNTY, Smithville, *V. Elliott in 1970* (WVA); SUMMERS COUNTY, Keeney's Knob, *W. B. Fox in 1939* (WVA); TAYLOR COUNTY, Boothsville, *G. E. Constable in 1959* (WVA); TUCKER COUNTY, along Location Road E of St. George, *R. B. Clarkson* 1494 (WVA); TYLER COUNTY, Raven's Rock, *E. E. Berkley in 1930* (MO); UPSHUR COUNTY, no further data, *W. M. Pollock in 1897* (MO); WEBSTER COUNTY, no further data, *J. B. Hinkle in 1957* (WVA); WETZEL COUNTY, N of Littleton, *O. Haught* 520 (WVA); WIRT COUNTY, bank of Reedy Creek near Palestine, *E. A. Bartholomew in 1948* (WVA); WOOD COUNTY, along a wooded road, *C. F. Millspaugh* 300 (WVA); WYOMING COUNTY, no further data, *D. S. Evans in 1962* (WVA). WISCONSIN: ADAMS COUNTY, 2.5 mi. W of Arkdale, *R. T. Brown* 92 (WIS); BROWN COUNTY, DePere, *T. Kellogg in 1888* (US); BUFFALO COUNTY, Fountain City, Eagle Bluff, *N. C. Fassett & L. Wilson* 5272 (GH, MICH, WIS); CALUMET COUNTY, no further data, *O. W. Meyer in 1964* (WIS); CHIPPEWA COUNTY, Brumet Island State Park, *M. Johnson in 1961* (WIS); CLARKE COUNTY, Neilsville, Listeman Arboretum, *J. E. Purcham* 501-64 (WIS); COLUMBIA COUNTY, Caledonia Township, up hill from Town Hall along 78, *D. E. Allen in 1945* (WIS); CRAWFORD COUNTY, 4 mi. S of Soldiers Grove, *R. Koch* 4127 (NEB, OSC); DANE COUNTY, Univ. of Wisconsin Arboretum, *H. H. Iltis* 27541 (MO, WIS); DOOR COUNTY, Peninsula State Park, 2.5 mi. NNE of Fish Creek, *H. R. Bennett in 1956* (CAS, RSA, UC, WTU); DUNN COUNTY, S of Elk Mound, *D. E. Meyer* 257 (WIS); FOND DU LAC COUNTY, Fond du Lac County Park, *J. M. Gates* 15 (WIS); FOREST COUNTY, 8 mi. SE of Crandon, *F. W. Stearns in 1946* (WIS); GRANT COUNTY, 3 mi. NW of Cassville, Nelson Dewey Memorial Park, *H. H. Iltis & J. Neess* 6437 (WIS); GREEN COUNTY, Spring Grove Maple Woods, Sec. 29, T1N, R9E, *K. T. Harper* 911 (UT); GREEN LAKE COUNTY, Marquette, *L. H. Shinnors in 1938* (WIS); IOWA COUNTY, upper N slope of Blue Mound, *Hoover & Green* 103 (KYO); JACKSON COUNTY, 5 mi. S of Merrilan, *D. F. Grether* 6048 (WIS); JEFFERSON COUNTY, 2 mi. S of Sullivan,

Bark River Game Preserve, *G. V. Burger 66* (WIS); JUNEAU COUNTY, Blackhawk Island, Wisconsin R., *D. Bramschreiber in 1959* (WIS); LACROSSE COUNTY, Onalaska Township, Sec. 26, T17N, R7, T. *G. Hartley 1200* (US, WIS); LAFAYETTE COUNTY, Fayette, *L. S. Cheney in 1888* (WIS); LINCOLN COUNTY, Merrill Township, Knight Lake, *F. C. Seymour 14530* (SMU); MANITOWAC COUNTY, Kiel, open woods near Cedar Lake, *N. C. Fassett & A. P. Hoffmann 18556* (MO, WIS); MARATHON COUNTY, 3 mi. SW of Hagarty, Eau Claire R. Park, *H. H. Iltis 20877* (WIS); MARINETTE COUNTY, bank of Peshtigo R., *C. O. Grassl in 1936* (MICH); MARQUETTE COUNTY, Sec. 1, T17N, R8E, *P. D. Sorenson 3276* (WIS); MILWAUKEE COUNTY, Glendale, 0.75 mi. W of Kletsch Park, *P. J. Salamun in 1969* (NLU, TUR); MONROE COUNTY, 7 mi. N of Tomah, *H. H. Iltis & G. K. Noamesi 6963* (WIS); OCONTO COUNTY, County Park on Oconto R., *R. A. & D. L. Schlising 996* (WIS); OUTAGAMIE COUNTY, Grand Chute, *F. C. Seymour 10257* (WIS); OZAUKEE COUNTY, ca. 3 mi. SE of Newburg, *W. W. Oppel et al. 1315* (WIS, WS); PEPIN COUNTY, Lake Pepin, *O. Anderson 207* (WIS); POLK COUNTY, Park, St. Croix Falls, *N. C. Fassett in 1934* (DAO, GH, IA, KYO, MIN, NY, UC, WIS, WS); PORTAGE COUNTY, valley of the Wisconsin R. near Stevens Point, *L. S. Cheney 3546* (WIS); RACINE COUNTY, Racine, *S. C. Wadmond 3230* (MIN); RICHLAND COUNTY, ca. 5 mi. N of Boaz, J. Shelton Farm, *R. G. Koch 7253* (KANU, MUR, NCU, UT); ROCK COUNTY, Spring Valley Township, *E. W. Fell 57-814* (WIS); RUSK COUNTY, N of Strickland, Devil's Elbow, *N. C. Fassett et al. 19958* (MO, NY, WIS); ST. CROIX COUNTY, Apple R. Canyon, 2 mi. upstream from junction with St. Croix R., *N. Russell in 1948* (MIN, WIS); SAUK COUNTY, Devil's Lake State Park, *J. H. Zimmerman 1145* (WIS); SAWYER COUNTY, Pickeral Lake, *H. H. Iltis 20613* (WIS); SHAWANO COUNTY, Sec. 21, T26N, R17E, *R. Liesner 135* (WIS); SHEBOYGAN COUNTY, woods at Elkhart Lake, *E. A. Bourdo 28657* (NLU); TAYLOR COUNTY, island in Rib Lake, *O. Anderson 206* (OKLA, WIS); TREMPLEAU COUNTY, Perrot Lake State Park, *T. S. & B. A. Cochrane 5285* (WIS); VERNON COUNTY, Chimney Rock, *B. Warnes & T. S. Cochrane 198* (WIS); WALWORTH COUNTY, Kettle Moraine State Forest, White-water Lake Recreation Area, *J. & C. Taylor 12064* (DUR, SMU); WASHBURN COUNTY, Minong, *C. Goessl 8524* (B, WIS); WASHINGTON COUNTY, Sec. 12, T9N, R18E, *M. Emmerick in 1960* (WIS); WAUKESHA COUNTY, between Hartland & Pewaukee, *I. Cull 1328* (WIS); WAUPECA COUNTY, Clintonville, *K. D. Rill in 1959* (WIS); WINNEBAGO COUNTY, Black Wolf Township, Kaspar's woods, *N. A. Harriman 5058* (WIS).

The only clear, non-overlapping character that can be used to separate *Circaea lutetiana* subsp. *canadensis* and subsp. *quadrisulcata* is the presence or absence of a minute setaceous bracteole at the base of the pedicel. *Circaea lutetiana* subsp. *canadensis* nearly always has the bracteole present. In general, *C. lutetiana* subsp. *canadensis* is larger throughout than subsp. *quadrisulcata* with the only obvious exception being in the length of the stamen filaments. Ascherson and Magnus (1870) were the first to point out the importance of bracteoles, and Hara (1939, 1952) has pointed out some less consistent differences, which are not always obvious in dried specimens. These include dark red (purple), glandular-pilose sepals, and pink petals in subsp. *quadrisulcata* and generally green, moderately glandular-pilose to glabrescent sepals, and white petals in subsp. *canadensis*. These characters are not mutually exclusive; plants with purple sepals are commonly found in North America and plants with green sepals can occasionally be found in Asia. Petal color is equally variable in plants from both parts of the world, but with a slightly greater tendency for Asian plants to have pink petals.

**4b. *Circaea lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Magnus, Bot. Zeitung (Berlin) 28: 787. 1870.—FIG. 9.**

*Circaea lutetiana* L. forma *quadrisulcata* Maxim., Prim. Fl. Amur. 106. 1859.

*Circaea quadrisulcata* (Maxim.) Franchet & Savat., Enum. Pl. Jap. 1: 169. 1873.

*Circaea mollis* Siebold & Zucc. var. *maximowiczii* H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 223. 1912.

Based on *Circaea lutetiana* L. forma *quadrisulcata* Maxim.

*Circaea maximowiczii* (H. Lév.) Hara, J. Jap. Bot. 10: 598. 1934.

*Circaea maximowiczii* (H. Lév.) Hara var. *viridicalyx* Hara, J. Jap. Bot. 10: 600. 1934. TYPE: Korea, Province Keiki, Koryo, 2 September 1930, T. Nakai (TI, holotype).

*Circaea maximowiczii* (H. Lév.) Hara forma *viridicalyx* (Hara) Kitagawa, Fl. Manshur. 328. 1939.

Plants 1.5–8 dm tall. The stem glabrous or with a few, very sparse, falcately recurved hairs, 0.2–0.3 mm long, on the upper internodes; petioles, leaves and inflorescence pubescent as in the species but never with long, straight or slightly curved, patent hairs, 0.5–1 mm long. Leaves 4.5–12 cm long, 2–5 cm wide, narrowly to broadly ovate to, more commonly, oblong ovate. Petioles 1.5–5 cm long. The terminal raceme ca. 2.5 cm long at initiation of flowering, to 30 cm long at cessation of flowering; the lateral racemes 2–5 cm long at initiation of flowering, to ca. 20 cm long at cessation of flowering. Flowering pedicels 0.9–4(–5\*) mm long, without a bracteole at the base. Fruiting pedicels 3–5(–6.3\*) mm long. Buds 2.6–3.8 mm long, 1.1–1.5 mm thick just prior to anthesis, most commonly purple. Ovary 1.2–1.7 mm long, 0.8–1.3 mm thick at anthesis, obovoid to subglobose. Floral tube 0.6–1 mm long, ca. 0.2 mm thick at the narrowest point, funnelform. Sepals (1.3–)1.9–3.2(–3.5\*) mm long, 1–1.7 mm wide, most commonly purple. Petals 1–2(–2.5\*) mm long, 1.4–2.5 mm wide, commonly pink; the apical notch 0.4–1.2 mm deep,  $\frac{1}{3}$  to slightly more than  $\frac{1}{2}$  the length of the petal. Filaments 1.6–3.5 mm long; anthers 0.3–0.7 mm long, 0.3–0.5 mm thick. Style (1.8–)3.2–4.2 mm long; stigma 0.2–0.4 mm tall, 0.3–0.6 mm thick. Nectar secreting disc 0.2–0.6 mm tall, 0.5–1 mm thick. Mature fruit 2.2–3.8 mm long, 1.8–3(–3.4\*) mm thick, pyriform to subglobose, broadly rounded at the apex, rounded, usually obliquely to the pedicel, with prominent ribs and deep sulci. Fruiting pedicels reflexed or recurved, often strongly so. Combined length of pedicel and mature fruit, (5.3–)6.5–8.5(–10\*) mm long. \* Measurements in plants from the Altai Mountains, U.S.S.R.

TYPE: U.S.S.R.?, Amur (“forma fructa 4-sulcata”) *C. Maximowicz* (LE, lectotype, not seen; GH, K, P, 2 sheets, isoelectotypes).

Distribution (Fig. 11): Cool-temperate, deciduous forests and transitional mixed deciduous-boreal forests. Central Far Eastern Asia in North and South Korea, northeastern China, and southeastern U.S.S.R.; Sakhalin; Hokkaido and Honshu (one collection), Japan; westward between 50° and 60° N. Lat. to the vicinity of Moscow, U.S.S.R.; northern Altai Mountains. From near sea level to ca. 1,500 m. Flowering, mid-June to mid-August and sporadically to early September.

#### Representative specimens examined:

##### U.S.S.R.

RUSSIAN S.F.S.R. Pskov, Velikoluzki, Romanova, A. Andrejev in 1900 (MW); Nizhegorov, Pavlovsk, Gorbatovski, opposite Voronova, D. Averkiev & N. Czernova in 1927 (MW); Birska, M. B. in 1839 (P); Primorski, Khasan, Kedrovaya Reservation in the Kedrovaya R. valley, V. Dvorakovskaja in 1973 (MHA); Minusinsk, Osnatjennaja, Ehnberg & Hammarström 762 (H, LD, S, TUR); Vladivostok, near Sedanka, S. J. Enander in 1926 (E); Voronezh, 50 km N of Voronezh, S. Golitsin in 1960 (DS); along the Enisej valley, M. M. Ilon et al. in 1931 (LE); Primorski, vicinity of Rardolnoye, R. Karpisonova in 1952 (MHA); Bashkirskaya, Arkhangel'skaya District, Solontsy, Duorava, A. Khokhrykov & M. Mazurenko in 1966 (MO); Orenburg, J. Klinge in 1846 (LE); Amurensy, Char R., V. Komarov in 1895 (BM, NY, TI, W); Omoso, Paludy valley, V. Komarov in 1896 (LE); Kazan Province, near Yadrin, Sura R., S. Korzhinsky in 1885 (MW); central Amur, St. Pojarkova, S.

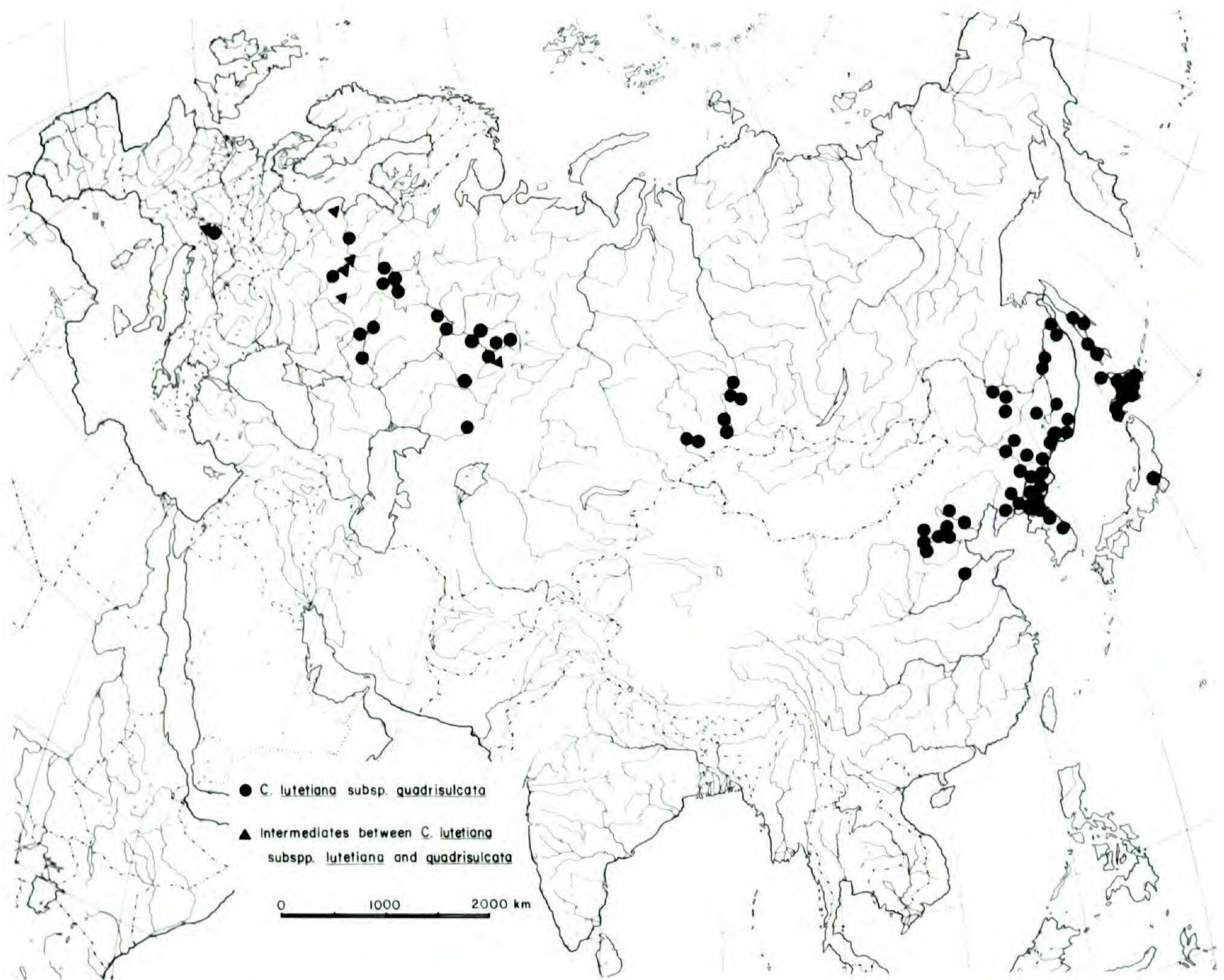


FIGURE 11. Distribution of *Circaea lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Mag.

*Korzshinsky in 1891* (GH, US); Kazan Province, Yadrin, *S. Korzhinsky in 1884* (ISC); Perm, Krasnoufimsk District, *S. Korzhinsky in 1887* (MW, UC); Moscow, Moscow District, Kuntzevo, *M. Koshevnikova in 1899* (G); eastern Sajon, Amil valley, *I. Krasnoborov in 1965* (LE); Tashbinsk District, Tashbin R., *I. Krasnoborov & L. Kurlina in 1966* (LE); Krasnoyarski Region, Shushenskaya, *I. Krasnoborov & M. Sukojan in 1964* (DAO); Krasnoyarski Region, Shushinsk District, *N. Leaborov & L. Gunderina in 1964* (LE); Korbekan at Amur R., *C. Maximowicz 1622* (BM, P); Vladimir Province, vicinity of Malenkovski, *M. Nasarov 4347* (MW); Ust'-Abakanskyi District, village of Trojakovo, *I. Neifeld & G. Vlasova in 1967* (LE); Ufa Province, Sterlitamak District, *I. V. & M. R. Novolokrovski & L. K. Mikhailov in 1926* (NY); Ufimskyi District, *I. V. Novolokrovski 1309* (LE); Rjazan, *P. P. Orlov in 1908* (MW); Kagan Province, village of Kozlovka, *A. Ostentkov in 1882* (H, MW); Czernigov, Suraj, *M. G. Popov 933* (MW); Mimusinsk District, Kusehabar, *H. Printz in 1914* (LD); Voronezh, Graboberensko Experimental Station, *D. Raskatov in 1949* (MW); Khabarovsk Province, Troitskoye District, near Majak, *V. Sapegina 53* (MHA); Possiet District, S Ussuri Province, *A. P. Saverkina 590* (NY); Altai, Achelman R. valley, *B. Schischkin & P. Krylov in 1911* (NY, TUR); Primorski Province, near Ussuriysk, *A. Schreter in 1950* (DS); Khabarovsk Province, vicinity of Khabarovsk, *V. Shaga in 1959* (MHA), *V. Shaga 13* (MHA); Moscow Province, Naro-Tominsk, near Alabino, *A. K. Skvortsov 10237, 10238* (DS); Tula Province, Oka R. valley near Krassnoje, *A. K. Skvortsov in 1971* (MO); Primorski Province, Rikard Island, *A. K. Skvortsov in 1967* (MO); Primorski Province, at the Kedrovaya R., *G. Smirnova 2205* (DS); Bahilovska, Zhigulevsk Forest Reserve, *A. Uranov & I. Syryna 1577* (MW); Primorski Province, Khasan District, vicinity of Barabasch, *K. Vegener in 1964* (MHA); Primorski Province, near Vladivostok, *V. N. Voroshilov in 1958* (DS); Primorski Province, near Okeanskaya, *V. N. Voroshilov 4728, 4851, 4883, 9136* (MHA); Khabarovsk Province, Bogorodskaya District, near Tir, *14 August 1975* (MHA). SAKHALIN: near Kromogorsk, *A. Chernyayeva in 1961* (MHA); Vladimirov, *U. Faurie 422* (BM, KYO, P), *423* (BM, P); Moneron Island, *S. Komat in 1915* (TI); Galkinovlaskoe, *T. Miyake in 1906* (SAPA); E coast, Dubki, *T. Miyake in 1906* (SAPA); Kotan, Todomoshiri, *T. Miyake in 1906* (SAPA); Futarakipaachi, *G. Nakahara in*

1906 (TNS); Torepata, *G. Nakahara in 1906* (TI); Moneron Island, *Stepanova 231a* (MHA); Fukakusa, *Kawagishi, S. Sugawara in 1926* (SAPA); Fukakusa, *S. Sugawara 167* (SAPA).

## ASIA

CHINA. HEILUNGKIANG: Harbin, *Jettmar in 1926* (W); Chi-hsi ("Tchi-sida-gou"), *V. Komarov in 1897* (P); near Shitokheza Station, *D. Litvinov 1968* (LE, NY); Sungari, Njelbu, *C. Maximowicz in 1859* (NY); at the Amur R., *N. M. Przewalski in 1867* (BM); I-ch'un Hsien, Wu-ying, *C. T. Tui et al. 7906* (PE). HOPEH: Peking, mountains, *A. David in 1862* (P); plains of Petcheli and mountains N of Peking, *A. David 438* (P); Hsiao-wu-tai-shan, Yang-kia-p'ing, Tang-lin, *H. Smith 230* (S, UPS); Cho-lu Hsien, Yang-chia-p'ing, Lao-po-ling, *C. K. Yang s.n.* (PE); Cho-lu Hsien, Yang-chia-p'ing, Tung kou, *C. K. Yang 606* (PE); Yung-ning, P'ai-t'a, *A418* (S); P'ai-t'a, Hsien-hwa, *H. Serre in 1930* (W); Ssu-t'a-kou, *in 1956* (PE 2150). KIRIN: Chang-wan, Ch'ai-lin-tun, *B. A. Ivashkevitch 487* (LE); Shen-yang to Chi-lin ("Mukden to Kirin"), Tang-ho-ko, *H. E. M. James in 1886* (K); Chang-pai-shan, and to Tang-ho-ko, Sungari R., *H. E. M. James in 1886* (K); O-mu-so, Palu-odi valley, *V. Komarov in 1896* (GH); O-mu-so, *V. Komarov in 1896* (K); O-mu Hsien, Tashantsuitzu, *H. W. Kung in 1931* (PE); Sung-hua-chiang ("Sungatschis"), *Maak s.n.* (K). LIAONING: Between the villages of Fu-eun and Dungan, *Y. L. Chang 56* (LE); Chi-kuan-shan, *M. Kitagawa in 1926* (TI) and *in 1931* (TI); Hoten, Renzankan, *I. Yamatsuta 951* (TNS). SHANSI (Shantung?): Mt. Tai-shan, *T. Shinagawa 64* (TNS). SHANTUNG: 500 km S of Peking, *L. Chanet & J. H. Serre in 1903-1935* (P); top of Mt. T'ai-shan (PE 384243). PROVINCE UNKNOWN: Chi-kuan-shan, *M. Kitagawa in 1931* (TI); Kankyo-do, Tozan-rei, *K. Maeda in 1907* (TI); Kou-tou, *M. Takahashi 51* (TNS); Tsuka, *M. Takahashi 986* (TNS); Coast of Manchuria, 44°-45° N. Lat., *C. Wilford in 1859* (W).

JAPAN. HOKKAIDO: Abashiri-shicho, along the Okoppe-gawa R. at Sako-hashii Bridge, *D. E. Boufford & E. W. Wood 19799* (CM, K, KYO, MHA, MO); Okoppe-cho, 15.9 km NE of Nishiokoppe, *D. E. Boufford & E. W. Wood 19812* (CM, K, KYO, MHA, MO, NCU, PE); Abashiri-gun, Tsubetsu-cho, Lake Chimikeppu-ko, *D. E. Boufford 19781* (KYO, MO); *T. Matsuki in 1974* (MAK); Abashiri-gun, Memambetsu-machi, en route from Memambetsu to Yobita, *M. Wakabayashi et al. 246* (KYO). Hidaka Shicho, Shizunai-cho, 14 km ENE of Shizunai, *D. E. Boufford & E. W. Wood 19671* (KYO, MO); Samani-gun, Samani-cho, Okada, *D. E. Boufford & E. W. Wood 19689* (KYO, MHA, MO, NCU, PE). Iburi-shicho, Numanohata, *J. Hanzawa in 1899* (SAPA); Oshamanbe, *T. Kawakami in 1892* (SAPA); Toikambetsu, *T. Saito 91,19* (SAPA). Ishikari-shicho, Sapporo, Mt. Maru-yama, *M. Hara in 1942* (TI); Sapporo, *K. Miyabe in 1891* (PH), *Y. Tokubuchi in 1890* (MO, SAPA); Sapporo, Makomenai, *Tokuguchi in 1894* (SAPA); Sorachi, Sorachibuto, *K. Miyabe in 1891* (GH, KYO, SAPA, TI). Kawakami-shicho, Nakagawa-cho, hwy 40 just S of Nakagawa, *D. E. Boufford & E. W. Wood 19826* (MO). Kushiro-shicho, Shibeche-cho, 3.6 km S of Shibeche, *D. E. Boufford & E. W. Wood 19751* (MO); Kawakami-gun, Shibeche Experimental Forest of Kyoto University, *D. E. Boufford & E. W. Wood 19765* (BM, CM, E, G, K, KYO, MHA, MO, NCU, NY, P, PE, S, SHIN, TUS, UC); Shibeche forests, *U. Faurie 4930* (G, P); Shibeche-cho, in the vicinity of Shibeche Experimental Forest, *H. Koyama 1729* (MAK, KYO); Kushiro, Tomachise, *H. Hara et al. in 1974* (KYO, TI); Yukiuchi-mura, *W. (K)obana in 1895* (SAPA); Kamiaboro, *A. Umezawa in 1956* (SAPA); Akkeshi-gun, Aikeppu-misaki, *T. Nakashima in 1960* (KANA); Sonteki, *K. Miyabe in 1894* (SAPA). Nemuro-shicho, side of Lake Furen, *K. Ito in 1962* (SAPA). Shiribeshi-shicho, foot of Mt. Yotei-zan, beside L. Hangetsu, *M. Mizushima 2605* (TI); Yoichi, *I. Yamamoto 4979* (KYO). Tokachi-shicho, Urahorochi, 10.2 km W of Tokachikobetsu, *D. E. Boufford & E. W. Wood 19723* (BM, CM, E, G, K, KYO, MHA, MO, NCU, PE, UC); Aikoku, Obihiro-shi, *G. Murata 22035* (KYO); Urahorochi, *H. Yokoyama 429* (SAPA); Ikera-cho, *H. Yokoyama 3173* (TI). SHICHO UNKNOWN: Oshima, Mena-kawa valley, *F. C. Greatrex 668* (SAPA); Asajino, *S. Watanabe in 1954* (SAPA); Lake Shibunai, *T. Sakuma in 1953* (SAPA); Kusuri, *K. Miyabe in 1884* (SAPA, TI); Rishiri Island, *S. Hori in 1887* (SAPA). HONSHU: Tochigi Prefecture, Nikko, *H. Ito 310* (TI).

KOREA, NORTH. Ouon-san, *U. Faurie 283* (K, P); Kan-nan, Senbutsu-san, *M. Honda 39* (TI); San-su, Yellow R., San-kori-muri, *V. Komarov in 1897* (LD); Kei-gyo, Kankyo-hoku-do, *M. S. Hi 958* (KYO); Kongo-san, Makkiri, *T. Nakai 5682* (TI); Koryu-do, Hokueibo, *T. Nakai et al. in 1933* (TI); Kankyo-hoku-do, Kisshu-gun, Eikodo, *J. Ohwi in 1930* (TNS); Eikodo, Reketsui R., *J. Ohwi 3065* (KYO); Mt. Kongo-san, *S. Okuyama in 1940* (TNS); Kankyo-hoku-do, Ranan, *T. Saito 1614* (KYO); Kankyo-hoku-do, Modzan, *T. Saito 2731* (KYO); Mt. Kogen-san, Kogen-do, *T. Uchiyama in 1902* (TI); Kankyo-hoku-do, Kainei, *K. Yoshinaga in 1934* (TNS); Kamkyong-puk-do, 10382 (MICH); Kakyo-do, Nanyo village, *no further data* (KYO).

KOREA, SOUTH. Kogen-do, Somoku-do, *T. Uchiyama in 1902* (TI).

KOREA, LOCALITIES UNKNOWN. Shosen-ri, San-zi, *T. Nakai 3678* (SAPA); Sanyo-eguchi, *T. Nakai 3543* (TI).



As mentioned above, *Circaea lutetiana* subsp. *quadrisulcata* is most similar to subsp. *canadensis* but differs from that subspecies in lacking a bracteole at the base of each pedicel. *Circaea mollis* is most similar to *C. lutetiana* subsp. *quadrisulcata* in eastern Asia but has the stem usually densely pubescent, smaller flowers, shorter pedicels, and abundant racemes at the apex of the stem and at the tips of many of the upper, axillary branches. In addition, the petals in *C. mollis* are always white and the sepals are always green. The leaf bases in *C. mollis* are cuneate and rarely almost rounded.

The ranges of *Circaea lutetiana* subsp. *lutetiana* and subsp. *quadrisulcata* overlap in the vicinity of Moscow and in the eastern part of the European Soviet Union but most specimens from that area can be attributed to one or the other subspecies without a great deal of difficulty, especially when mature fruits are available. Further field work in this area of overlap should be carried out to determine the amount of intergradation that occurs in the two subspecies.

A single specimen of Polatschek (in 1973, W) from the lower Isel Valley of Austria between Lienz and Tratte, is puzzling in that it is unmistakably *Circaea lutetiana* subsp. *quadrisulcata*. Whether this collection represents a recent introduction, the extent of possible variation in the European *C. lutetiana*, or a previously unknown, disjunct population is uncertain. Field work by persons in a position to do so should be undertaken to determine the nature of this population.

H. L veill  (1912) listed two names under *Circaea mollis* Sieb. & Zucc. var. *maximowiczii* H. L v., "pogogyna" and "pachystyla," that need clarification. Based on L veill 's consistent use of the terms forme, var., etc. to precede names that he wanted to recognize formally, it does not appear to be his intent to assign any particular taxonomic rank to these two names but only to point them out as "lusi" (sports, variants) of var. *maximowiczii*, as he similarly did under *C. lutetiana* with "albiflora," "rubriflora," "cordifolia," etc., even though in his preceding sentence he states "One can distinguish the following two forms:" (trans. from French).

#### 4c. *Circaea lutetiana* L. subsp. *lutetiana*—FIG. 12.

*Circaea major* Lam., Fl. Fr. 3: 473. 1778. Nom. subs., *C. lutetiana* L. in syn.

*Circaea vulgaris* Moench, Meth. 279. 1794. TYPE: Germany, "frequens an der Schneisse prope Gieselberg." According to Ascherson and Magnus (1870), Moench's herbarium was ". . . just recently lost through the lamentable carelessness of the owner, . . .").

*Circaea nemoralis* Salisb., Prod. 276. 1796. Nom. subs., *C. lutetiana* L. in syn.

*Circaea racemosa* Hull, Br. Fl. 6. 1799, pro parte. Nom. subs., *C. lutetiana* L. and *C. alpina* L. in syn.

*Circaea racemosa* Hull var. *lutetiana* (L.) Hull, Br. Fl. 6. 1799.

*Circaea pubescens* Pohl, Tentamen Fl. Bohemiae 1: 6. 1809. Nom. subs., *C. lutetiana* L. in syn.

*Circaea ovalifolia* Stokes, Bot. Mat. Med. 1: 26. 1812. Nom. subs., *C. lutetiana* L. in syn.

*Circaea lutetiana* L. forma *ovatifolia* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.

*Circaea lutetiana* L. forma *cordifolia* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.

*Circaea lutetiana* L. forma *glaberrima* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.

*Circaea lutetiana* L. var. *cordifolia* G. Meyer, Chl. Hanover 100. 1836. TYPE: only locality given by Meyer for this variety is "im Herrenhauser Park" (GOET, a specimen labelled by G. F. W. Meyer as type).

*Circaea lutetiana* L.  $\beta$  *glabra* Petermann, Fl. Lips. Excurs. 28. 1838. The herbarium at Leipzig, where Petermann's specimens were probably deposited, was destroyed during World War II.

*Ocismastrum verrucarium* (Gesner & Bauhin) Rupr., Fl. Ingr. 368. 1860. Nom. subs., *C. lutetiana* L. in syn.

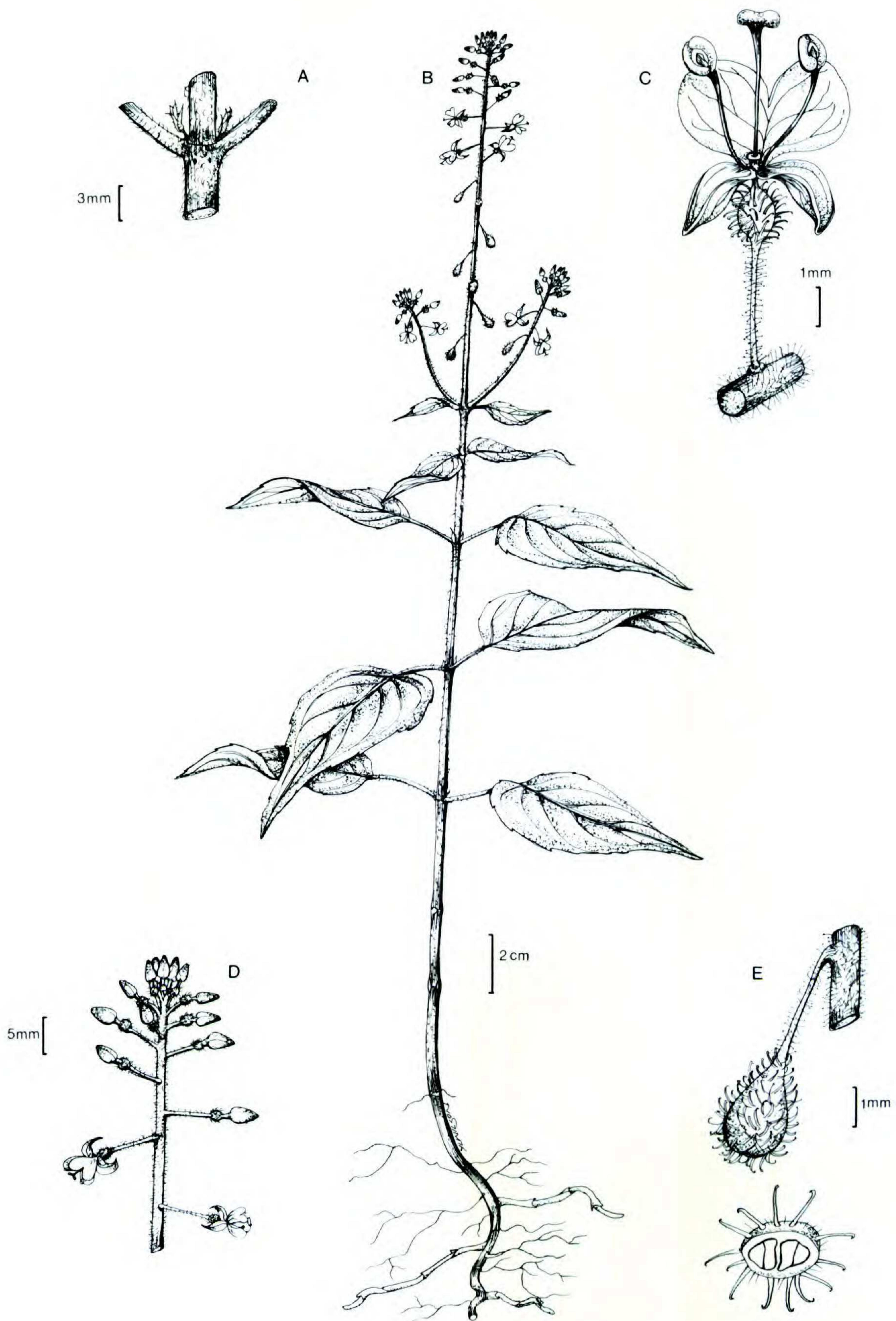


FIGURE 12. *Circaea lutetiana* L. subsp. *lutetiana*.—A. Node of upper stem.—B. Habit.—C. Flower with petal removed; note exerted nectary.—D. Inflorescence.—E. Fruit. From Skvortsov *s.n.* (MO 2352081).

- Circaea lutetiana* L. var. *obscurata* Grognot, Carian Cat. Pl. Saone-et-Loire 153. 1863. TYPE: France, moist mountain forests between St. Prix and Goulette, and towards Crot-Maxin R. (AUT, lectotype).
- Circaea lutetiana* L. var. *atrosanguinea* F. Schultz, Pollichia 20: 144. 1863. TYPE: Germany, on the porphyry of Yburg near Baden.
- Circaea lutetiana* L. var. *decipiens* Asch., Fl. Prov. Brandenburg 2: 214. 1864. TYPE: Not located.
- Regmus lutetianus* (L.) Dulac, Fl. Hautes Pyr. 328. 1867. Nom. illegit.
- Circaea lutetiana* L. var. *erythrocalyx* O. Kuntze, Taschen Fl. Leipzig 257. 1867. TYPE: E. Germany, in forest before Leutzsch. Kuntze's collections were at Leipzig, which was destroyed during World War II.
- Circaea lutetiana* L. subsp. *mediterranea* Asch. & Magnus, Bot. Zeitung (Berlin) 28: 783. 1870. TYPE: Not located.
- Circaea lutetiana* L. var. *glaberrima* (Lasch) Asch. & Magnus, Bot. Zeitung (Berlin) 28: 780. 1870.
- Circaea lutetiana* L. var. *brevipes* Battand., in Battandier and Trabut Fl. Alg. (Dicotyl.) 317. 1889. TYPE: Algeria, stream of Singes, Djurdjura.
- Circaea lutetiana* L. var. *longipes* Battand., in Battandier and Trabut Fl. Alg. (Dicotyl.) 317. 1889. TYPE: Algeria.
- Circaea lutetiana* L. var. *ovatifolia* (Lasch) Beck, Fl. Nieder-Oster. 2: 695. 1892.
- Circaea lutetiana* L. var. *cordifolia* (Lasch) Beck, Fl. Nieder-Oster. 2: 695. 1892. non G. F. W. Meyer, 1836.
- Circaea lutetiana* L. var. *villosa* Beck, Fl. Nieder-Oster. 2: 695. 1892. TYPE: Austria, on the Thalhofriese of the Schneebergs.
- Carlostephania major* (Lam.) Bubani, Fl. Pyrenaea 2: 659. 1900. Nom. illegit.
- Circaea lutetiana* L. forma *mediterranea* (Asch. & Magnus) Paol., in Fiori & Paoletti, Fl. Anal. It. 2: 135. 1900.
- Circaea lutetiana* L. var. *hirsuta* Podp., Verh. Zool. Bot. Ges. Wien 52: 650. 1902. TYPE: "Cepelare in den Rhodopen."
- Circaea lutetiana* L. forma *pseudo-cordata* H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 218. 1912. No specimens cited.
- Circaea lutetiana* L. forma *hirtopetiolata* H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 218. 1912. No specimens cited.
- Circaea lutetiana* L. forma *brevipes* (Battand.) H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 218. 1912.
- Circaea lutetiana* L. var. *typica* Fiori, Nuov. Fl. Anal. It. 2: 15. 1925.
- Circaea lutetiana* L. forma *aprica* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 877. 1925.
- Circaea lutetiana* L. forma *albiflora* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 878. 1925.
- Circaea lutetiana* L. forma *longipetiolata* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 877. 1925.
- Circaea lutetiana* L. forma *rubriflora* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 878. 1925.
- Circaea lutetiana* L. forma *truncata* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 877. 1925.
- Circaea lutetiana* L. forma *umbrosa* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 877. 1925.
- Circaea lutetiana* L. forma *carneostyla* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 878. 1925.
- Circaea lutetiana* L. subvar. *cordifolia* (Lasch) Hayek, Prod. Fl. Balk. Pen. 1: 949. 1926.
- Circaea lutetiana* L. forma *hirsuta* (Podpera) Hayek, Prod. Fl. Balk. Pen. 1: 949. 1926.

Plants 1.5–9 dm tall, densely to sparsely pubescent, rarely the stem subglabrous; the stem with soft, falcately recurved hairs ca. 0.2 mm long, sometimes with capitate and clavate-tipped hairs ca. 0.4 mm long and soft, sharp-pointed, straight or slightly curved, patent hairs intermixed; the petioles with hairs as on the stem but the falcate hairs upwardly curved; the leaves glabrous or, more commonly, pubescent, especially near the base and along the main veins on the lower, and occasionally also on the upper surface, with soft, falcate hairs and occasionally also with long, straight hairs ca. 1 mm long if these present on the stem, interveinal areas less densely or scarcely pubescent; leaf margins with short falcate cilia and with long straight hairs if these present on the stem. Leaves (3–) 6–11(–15) cm long, (2–)3–5.5(–12) cm wide, very broadly elliptic to deltoid ovate but most commonly ovate to lanceolate ovate. Petioles densely to sparsely pubescent, with upwardly curved, falcate hairs ca. 0.2 mm long, sometimes with longer, straight or slightly curved hairs, 0.5–0.8 mm long, intermixed if these present on the stem. Flowering pedicels (2–)3–5.2(–9) mm long, without, very

rarely with, a minute setaceous bracteole at the base. Fruiting pedicels 3.8–6 (–10) mm long. Buds (2.4–)3.2–4.5(–5.4) mm long, 1–1.9 mm thick just prior to anthesis. Floral tube (0.8–)1.1–1.8(–2.4) mm long, linear obtriangular to slender funnellform in outline. Sepals oblong to ovate, (1.6–)2.5–3.5(–4.5) mm long, (0.8–)1.2–2 mm wide. Petals (1.4–)2–3.7 mm long, (1.8–)2.3–3.4(–4) mm wide, white or pink; the apical notch (0.6–)1.6–2(–2.4) mm deep,  $\frac{1}{2}$  to slightly over  $\frac{1}{2}$  the length of the petal. Filaments 2.5–3.5(–4.3) mm long; anthers 0.6–0.8(–1) mm long, 0.3–0.6(–0.9) mm thick. Style 3.3–4.5(–6) mm long; stigma 0.2–0.4(–0.6) mm tall, 0.4–0.9 mm thick. Nectar secreting disc 0.2–0.6 mm tall, 0.3–0.5(–0.9) mm thick. Mature fruit 2.8–3.3(–3.8) mm long, 1.4–2(–2.4) mm thick, clavate to obovate, rounded at the apex, tapering smoothly to the pedicel, without prominent ribs and sulci. Fruiting pedicels reflexed, often sharply so. Combined length of pedicel and mature fruit (6.3–)8–11(–15) mm long. Gametic chromosome number,  $n = 11$ .

LECTOTYPE: Sheet 25-1 (LINN) "lutetiana 1," presumably from southern Sweden, can be considered as the lectotype; Linnaeus (1753) wrote the diagnosis for *Species Plantarum*, and doubtless knew the species well.

Distribution (Fig. 13): Moist, temperate deciduous forests, commonly with *Fagus*, *Carpinus*, and *Alnus*. Southern Scandinavia south to the mountains of northeast Africa, along the north side of the Mediterranean Sea and eastward to northeastern Iran, from the Caucasus Mountains to southwestern U.S.S.R. and through Poland to the Baltic Sea, scattered eastward to the vicinity of Moscow. From sea level to ca. 2,200 m. Flowering, June through August.

#### Representative specimens examined:

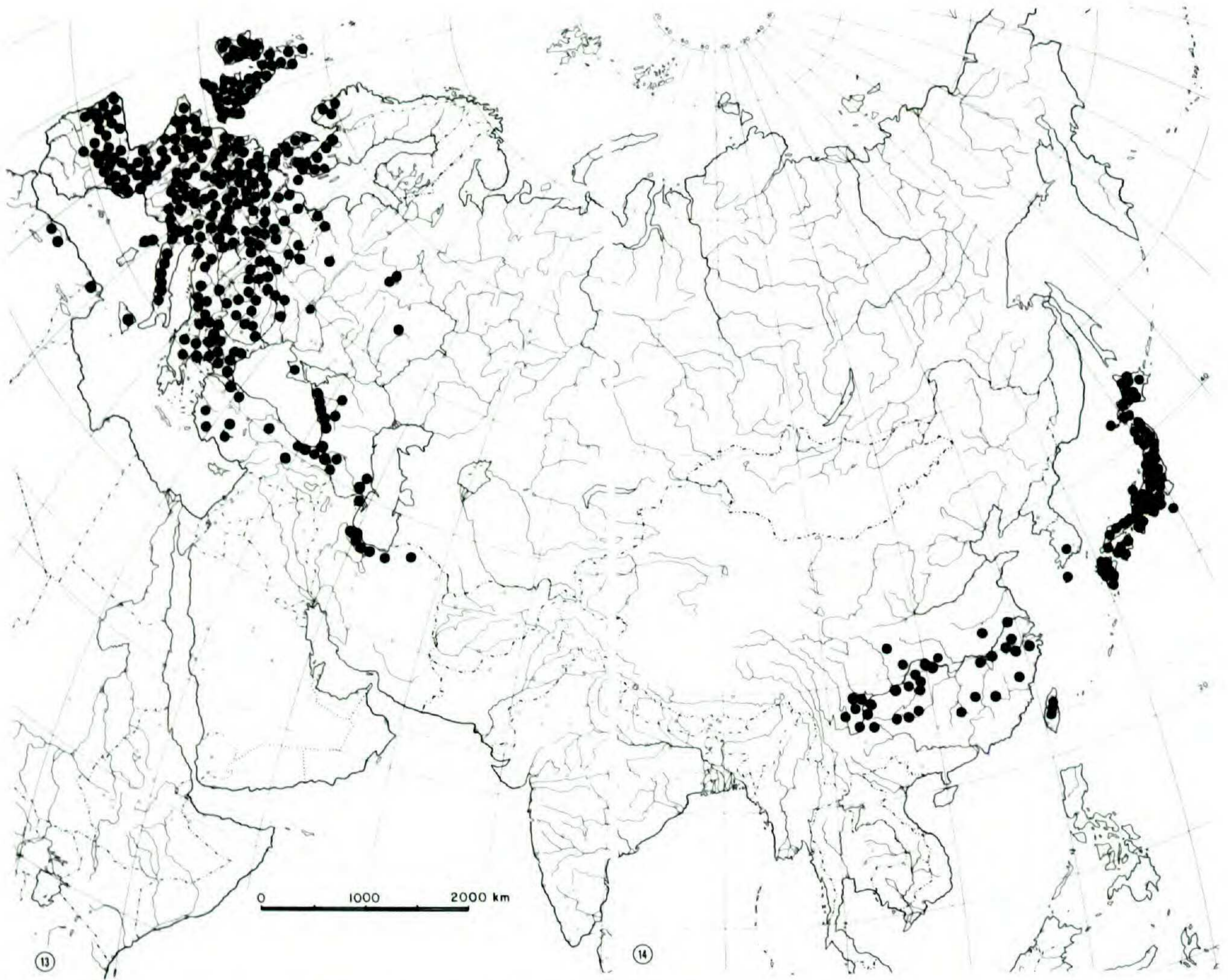
##### EUROPE

ALBANIA. Klementi, A. Balacci 219 (G, W).

AUSTRIA. Mur R. ca. 1 km E of Peggau, R. Alava & H. Teppner 2950 (TUR); Marchau, Marchegg, Drescher in 1971 (W); Vienna, Heimerl in 1923 (OKL, WTU); Schwertberg, Keck s.n. (UC); Aisterheim, Keck s.n. (ISC, MO, POM, UC, W); Salzburg, Etenan, E. Korb in 1924 (W); Salzburg, in the vicinity of the salt works, E. Kreiamitz in 1845 (UC); Vorarlberg, Jagdberg near Schlins, A. Neumann in 1967 (W); Vorarlberg, Bocksberg near Neuburg, A. Neumann in 1967 (W); Arnoldstein, A. Palmer in 1870 (H); N Weisskirchen, Ohrensdorf, F. Petrolz 835 (SUM); Tyrol, Thal, T. Pichler in 1896 (US); Kärnten, Becken, S of Klagenfurt, Pokorny in 1920 (W); Vorarlberg, Feldkirch, A. Polatschek in 1968 (W); Vorarlberg, Rheingau, Bregenz, A. Polatschek in 1971 (W); Nordtirol, Oberinntal, A. Polatschek in 1972 (W); Steiermark, near Deutschlandsberg, E. Preissmann in 1867 (W); Steiermark, near Mixnitz, E. Preissmann in 1895 (W); Vorarlberg, Bregenzerwald, Pfänder-Gebiet, Gebhartsberg, R. Seipka in 1971 (W); SE Steiermark, near the Schlossmeirei, R. Seipka in 1970 (W); Steiermark ("Stiria media"), Stainzerbach R. near Stainz, P. v. Troyer, Fl. Stir. Exs. 644 (DS, H, ND, UC, W); Steiermark ("Stiria superior"), Gröbming, E. Wibiral, Fl. Stir. Exs. 643 (H, ND, W); Dornbach, Vindobonen, Woloszczak, Fl. Exs. Aust.-Hung. 1274 (B, H, L, MIN, US, W).

BELGIUM. Liege, Vierset-Barse, P. Auquier 3161 (H, TUR); Henri Chapelle, E. Bodart in 1913 (WTU); Heysel, forests in vicinity of Hosseghem, M. Gams in 1924 (UC); Beaumont, A. Hardy 278 (MT); Meise, Bouchont, A. Lonobrie 12542 (PH); Theux, M. Mairlot in 1904 (MO); Pirengen, Colmont, Michiels in 1931 (MT); Anlier, Wilezele 793 (MO); Vertrijk, A. Thielens in 1863 (R).

BULGARIA. Varna, L. Brumll in 1886 (B); Sofia region, N. Nikolov 853 (G, H, MA, UBC, W, WU); near Karlova, N. Vihodcevsky in 1968 (GOET); Pieniawka, Momina Klisura, T. Wisniewski & H. Slivinska in 1927 (WA); Gorna Ljubata, Kjustendil Dist., (SOM 54479)\*; Vibosha Mt., (SOM 54459); near Teteveni, (SOM 54477); Gradishte near Gabrovo, (SOM 54473); Borushtica, Stara Zagora Dist., (SOM 54474); Karash, Lukovit Dist., (SOM 54475); Balkan Mt., Bertemeto, (SOM 129063); Rodopy Mts., near Bachkovo, (SOM 54464); Balkan foothill Mts., Zlabaritza Veliko Tarnovo Dist.,



FIGURES 13–14.—13. Distribution of *Circaea lutetiana*. L. subsp. *lutetiana*.—14. Distribution of *Circaea erubescens* Franch. & Sav.

(SOM 54458); Ljubin Mt., near the monastery, (SOM 130262); Strandza Mt., near Gramatikova, (SOM 43597). \* Data for specimens in SOM were supplied by Mincho Anchev.

CZECHOSLOVAKIA. Brno, near Komarov, *O. Mrkos* 351 (CAS, DAO, H, KRA, MT, POM, TUR, W, WA); Malinec, *Priluitz* in 1868 (US); E Moravia, Novy Hrozenkov near Vsetin, in the Skalici valley, *G. Rican* 1149 (DAO, DS, H, KRA, MO, MT, POM, TUR, UC, W, WA).

DENMARK. Charlottenland, *G. Bagenholm* in 1893 (MIN); Sjælland, Skodsborg, *U. Bailund* in 1929 (H); Island of Möen, *J. Ball* in 1888 (IA); Hammerbakker, dist. 4, *L. Br. Holm-Nielsen* in 1966 (MO); Hanstedskov, dist. 24, *L. Br. Holm-Nielsen* in 1966 (MO); Tarbaek, *H. Gravers* in 1887 (H); Tåsinge Island between Fyn & Langeland, *K. U. Kramer* 5829 (NCU); Jutland, Lisbjerg, N of Aarhus, *K. Larsen* 155 (COLO, DS, H, MA, SMU, US, W, WTU); Ermelunden, Gentsoste, *K. Larsen* in 1956 (H, SMU); Sjaelland, Vesterskov woods near Furesø, N of Copenhagen, *T. Leth* in 1861 (DS); Sjaelland, Fredensborg, *H. Muchardt* in 1915 (RSA); Lolland, dist. 36, Nysted landsogn, Roden Skov, *C. M. Normann* in 1959 (DAO, MT, RM); Bornholm, Åkirkeby, *H. Roivainen* in 1977 (H); Kööpenhamina, Uesterbrohau, *H. Sältin* in 1961 (TUR); Sjaelland, Vordingborg, Rosenfelt, *T. Sundin* in 1964 (CAS); Jylland, Horsens, *J. Suominen* in 1965 (H); Zealand, S of Haraldsted Sø, Ringsted, *J. Svendsen* 62 (COLO, H, MO, NCU, OMA, PH, TUR, UBC, W); Sjælland, Lyngby, *L. Tiensuu* in 1950 (H); Svendborg, Fyen, *without collector* in 1869 (MT).

FRANCE. Aisne, Villers, Cotterets, *C. d'Alleizette* 951 (K, RSA); near Sarrebourg, *Baudot* in 1868 (POM, mixed sheet, with *C. × intermedia*); Gannat, *P. Billiet* 929 (MT); Servoz, Alta Sabaudia, *Bouchard* in 1910 (MO); Deux-Sevres, near Lezay, *E. Contre* in 1959 (CAS, DAO); Aisne, central Jura, Bas-Bugey, St. Boys, *H. Coste & Brunard* 2087 (MT); Gironde, La Brede, Chateau, *H. Coste et al.* 1282 (MT); Beziers, *Daenen* in 1855 (G); Compiègne, *F. Debray* 1996 (UC); Dauphine, St. Marrellin, *Delannay* in 1891 (W); Argeles, *B. Delessert* in 1894 (G); Baugy, *P. Eveque* in 1898 (H);

St. Georges d'Espiranches, *G. Gavelle* in 1968 (CAS); Savoie, Mt. Mirz, *Geneva* in 1825 (US); Gap au Chauret, Alps, *Girod* in 1904 (G); Corsica, Lopigna, Cruzzini R., *H. v. Hattum* 5626 (L); Bretagne, Quimper, *Hodgdon & Hodgdon* 16443 (NHA); Mauleon-Soule, Haies, *J. Jallu* 1223 (RO); near Paris, *E. Jeanpert* in 1890 (MIN); Lyon, *Herb. Jordan* in 1853 (W); Brittany, near Huelgoat, *S. L. Jury* 417 (RNG); Corsica, Bastia, *L. Kralik* in 1849 (G); Nierve, Dornes, *S. Lassimonne* 66 (US); Normandy, Montmiral, *A.-L. Latacq* in 1908 (COLO); Aude, Bassin de St. Ferreol, *J. C. v. Loon* 414 (NCU); Jersey Island, St. Sauveur-de-Jersey, *Louis-Arsene* 4098 (DAO); Creuse, St. Avit-de-Tardes, *R. Lugagne* 2981 (DAO, H, SMU, TEX), *R. Lugagne* 6680 (LD, TUR); Pringy, *Luget* in 1867 (MO); Teine et Oise, Mendon, *Mouillefarine* in 1882 (CM); Boubonne les Bains, Mt. Marne, *Mouillefarine* in 1888 (UMO); Versailles, *K. L. Oesch* in 1924 (TUR); Bretagne, St. Lunaire, *B. Ohovi* in 1949 (H); Paris, *Parmentier* circa 1812 (PH); Nantes, Seminary Property, *Br. J. Peter* in 1908 (DAO); Corsica, Corti, *Pittone s.n.* (W); Corsica, Cargiaca, *A. Renvall* in 1905 (H); Eclaron, *B. de Retz* in 1933 (WTU); Corsica, Evisa, *E. Reverchon* 423 (DS, G, K, MA); Vaucresson, *W. Schoenefeld* in 1843 (H); Versailles, *I. Tidestrom* 12317 (NA); above Rouen, Mt. St. Aignan, *I. Tidestrom* 12970 (US); Hautot, St. Sulpice, *I. Tidestrom* 13875 (POM, US); vicinity of Paris, *G. B. Wakeman s.n.* (CM); Chaiville, *Veligy*, without collector in 1908 (H).

GERMANY, EAST. Leipzig, *A. H. R. Buller* in 1898 (WIN); Lobau, *G. Cufodontis* in 1925 (W); Magdeburg, *H. Eggert* in 1866, 1867 (MO); Leipzig, *G. Fischer* in 1895 (SMU); near Potsdam, *Jochin s.n.* (H); Büchenwaldern near Kalksburg, *E. Korb* in 1918 (W); Erzgebirge, from Doppelburg via Eichwalds to Fuchsbütteljagdhaus, *E. Korb* in 1925 (W); Leutzsch, *O. Kunze* in 1862 (US); Kaltern, *P. Morandeff s.n.* (W); Dresden, *Reichenbach s.n.* (PH); Thüringen, *E. M. Reineck* in 1900 (MIN); Mecklenburg, Parchim, *H. Roos* in 1904 (H); Tharandt, *R. Sarvas* in 1920 (H); near Stöcker, *F. Schwarzl* in 1871 (W); around Wiesenränder, W of Gleichenberger-burg, *R. Seipka* in 1970 (W); Alta Statberg, *Vock* in 1882 (MSTR, US); Karlmarxstadt (Chemnitz), *M. Weicker* in 1829 (W).

GERMANY, WEST. Erlangen, *M. Beiapts* in 1861 (MO); Upper Hessen, *O. Degener* 23399 (SMU); near Monkenbursch, Menningshausen, *Dubruck* 2290 (MSTR); Hannover, *Erhart* 121 (W); near Oberaudorf and Fischbach, *G. Eigner* in 1903 (UC, WA); Frankfurt, *G. Engelmann* in 1820 (MO); Holstein, Ostsee coast, *Girtf?* in 1935 (W); Heidelberg and vicinity, *Girtf?* in 1935 (W); Hessen, Starkenburg, *Girtf?* in 1928 (W); Hessen, Rheinhessen, *Girtf?* in 1915 (W); Holstein, Lübeck, *Girtf?* in 1938 (W); near München, *H. Glück* in 1906 (W); Hohenstadt, *T. Hruby* in 1933 (H); Oberhessen, Kreis Alsfeld, Gr. Felda, *H. Hupke* in 1958 (OKLA, SMU); Kreis Alsfeld, Liederbach an Waldwegen, *H. Hupke* in 1964 (SMU, VDB); Kreis Alsfeld, Weidenberg, *H. Hupke* in 1965 (UT); Kreis Alsfeld, Koppenberg, *H. Hupke* in 1967 (MONTU); Kreis Alsfeld, Liederbacher Teich, *H. Hupke* in 1969 (SASK, USAS); Schleswig-Holstein, Siebenbaumen between Bad Oldesloe and Ratzeburg, *S. Jepsen & K. Larsen, Fl. Germ. Exs. 30* (COLO, DS, GOET, H, MA, SMU, TUR, W, WTU); Emmendingen, Nimburg, *V. Kap* 128 (W); between Oberstem and Wildenburg, *C. Knabe* in 1905 (H); Aachen, *P. Krabler* in 1857 (W); Botenwald, Mähren-Odertal, *K. Krischke* in 1926 (B); Württemberg, Rossberg, *B. Lindberg* in 1891 (H); Isarthal near Grosshesselohe, *C. J. Mayer* in 1902 (UC); Holstein, Lockstedter Lager, *L. Oesch* in 1915 (H); Baden-Württemberg, Stuttgart-Vaihingen, S of Kurmärkerster, *J. Penalosa* 2903 (CAS); Westfalen, Meinberg, *Prager s.n.* (CAS); Berner Alps, *P. Reinsch s.n.* (OS); Kaiserstuhl, Schelingen near Breisach, *Stud. Biol. Rheno-Trai. 61-1936* (NCU); Sud-Niedersachsen, near Othfressen, *I. & H. Scholz* 70216 (NCU); Hessen-Nassau, near Bassel, *Schulz* in 1906 (B); Hamburg, *Steetz s.n.* (PH); E of München, S of Rosenheim, *P. Votila* 20890 (H); Schleswig-Holstein, near Niendorf, *G. Wagenitz* 454 (B); Oberhayn near Warstein, *Herb. Wiemeyer* in 1917 (MSTR); Ruckeburg, *Wze* in 1926 (MSTR); Minden, *Wze* in 1926 (MSTR).

GREECE. Thassalia, Mt. Telio, *T. Aphentubis* in 1887 (WU); Mt. Athos, *N. Ballalas* in 1921 (US); Ipiros, Ionnina, Vikos Gorge below Kapesovo, *C. N. Goulimis* 15181 (ATH); E Macedonia, Sidiro-nezi-Skaloti, *C. N. Goulimis* 15178 (ATH); E Macedonia, Halkidiki, Mt. Ayion-Ozos (Mt. Atkos), *C. N. Goulimis* 15177, 15180 (ATH); E Macedonia, Boz-Dag, Ajios Petros-Mili, *C. N. Goulimis* 15179 (ATH); Athos Pen., Moni Thilotheon, *C. N. Goulimis* in 1947 (K); Thessalia, Agrafa, Mt. Pindo, *T. Heldreich* in 1885 (WU); Volos, Zagora, *Raus* 949 (ATH); Thasos, 4 km SSW of Thasos, *S. Snogerup* in 1971 (LD); W Macedonia, Pella, Almopia Dist., Platza, *E. Stamatiadou* 19472 (ATH).

HUNGARY. Felső Mocsolad, *L. Bano* in 1946 (DAO); Debrecen, Hajdu, *R. Rapaics, Fl. Hung. Exs. 762* (DAO, H, MO, TUR, UC, W, WU); Carpathian Mts., Lct. Georgen, *A. Zahlbruckner* in 1884 (W).

ITALY. Certosa di Pesio, *J. Ball* in 1887 (CAS); near Bagni di Lucca, *J. Ball* in 1844 (PH); Grappa, Mt. Bassanensium, *J. Ball* in 1858 (MO); Piedmont, Luserna valley, *J. Ball* in 1860 (MTMG); Rome, Latium, Paliano, *A. Beguinot* 896 (K, NEB, RO, WU); Apennine Mts., *P. Bubani* in 1804 (NMC); Rome, *A. Cacciato* in 1954 (SMU); Genova, *Canepa* in 1885 (RO), *R. Canneva* in 1907 (H); Liguria, Polcavera valley, *R. Canneva* in 1907 (RO); Bergamasques, Lake Rocco, *P. Chenevard* in 1912 (G);

Bergamasques, Malgina valley, *P. Chenevard* in 1913 (G); Sicily, Tortorici, *Citarda* 726 (CM, PENN, RO); Toscana, Pracchia, *A. Contardo* in 1953 (SMU); Albano, *F. Cortesi* in 1880 (RO); Trieste, Rojano, *V. Engelhardt* in 1884 (L); Scalenghe, *P. Fontana* in 1924 (DAO); Bagni di Lucca, *O. Grampini* in 1901 (RO); Neapolitani, St. Rocco R. valley, *Heldreich* 51 (W); Napoli, *D. Hildreith* in 1840 (G); Trieste, *Lani* in 1952 (RO); Castagneta, *G. Lunne* in 1957 (RO); Casalta, *A. Nabelli* in 1886 (RO); Venaria Reale, Torino, *E. R. Paoletti* in 1903 (NEB); Campagnano, *A. Pappi* in 1900 (RO); Sicily?, Tusa, *Parlatore* in 1877 (WU); Matese, *N. A. Pedicino* in 1876 (RO); near Rome, *A. Pelosi* in 1887 (PENN); S Michele in Teverina, *A. Poppi* in 1900 (RO); Toscana, Massa, Resceto, *A. Ranhala* in 1964 (H); Cottian Alps, *E. Rostan* in 1880 (L); Tuscany, *D. Salla* in 1890 (L); Massa, Rocca, *Wellegrini* in 1940 (H); Friuli, *G. Zamburlini s.n.* (RO); Sicily, Caronia, *without collector* in 1850 (G); Mt. Elmo, *without collector & date* (W).

LUXEMBOURG. Diekirch, *Denonville* in 1952 (W).

NETHERLANDS. Utrecht, *C. C. Berg et al.* 1000 (H, MA, MT, NCU, NO, TUR, UC, WTU); near Utrecht, forest of Oud-Amelisweerd, *H. F. J. v.d. Brugge* in 1950 (MO, SMU, US); Domburg, *J. Burger* in 1947 (MT); Utrecht, *F. Hartsen* in 1860 (W); Oldenzaal, *L. G. Kop* in 1948 (UC); Overijssel, Schijvenerveld near Delden, *P. v. Royen* in 1948 (TEX); Wageningen, *K. d. Vries* in 1948 (UC).

NORWAY. Hordaland, Skånevik, *T. Braarud* in 1927 (H); Midthordland, Hatviken, *R. Fridtz* 24940 (H); Hordaland, Skånevik, *Fjaere, I. Jørstad* in 1913 (SASK); Hordaland, Vangdalsberget, *S. K. Selland* in 1915 (MT); Hordaland, Kvinnherad hd., *S. K. Selland* in 1912 (COLO).

POLAND. Gdansk, Elblag (Danzig, Elbing), *C. Baenitz* in 1881 (MSTR, W); Wroclaw (Breslau), between Oberglauche and Skarsine, *C. Baenitz* in 1898 (B, US, W); Pommerana, Kolobrzeg (Kolbergmünde), *C. Baenitz* in 1881 (MSTR); Tomaszow, *F. Blonski* in 1890 (WA); Brenna Leinica-Beskid Slaski, *M. Broda* in 1968 (KRA); Brenna Holcyna-Beskid Slasky, *M. Broda* in 1967 (KRA); Vilpotny, Pornachowice Dolne, Myslenichi, *V. T. Dobranske* in 1925 (KRA); Gostynski, Konstantynow, *K. Drymmer* in 1895 (WA); Gostynin Dist., Sanniki, *K. Drymmer* 628 (W, WA, WU); Silesia, Slask Dolny, Wzgorze Joanny K. Milicza, *S. Golowin* 41 (DAO, H, SMU, TUR, WA); Nowy Sacz Dist., Lomnica Zdroj., *K. Grodzinska* in 1957 (MO, US); Dobrzynska, *A. Halewski* in 1890 (WA); Wroclaw (Breslau), *G. Hieronymus* in 1890 (WA); Premyslany, Podalia, *Kostrakiewicz* in 1930 (POM, US); Carpatian Mts., Mt. Beskid Niski, *I. Kucowa & H. Piekos* 137 (COLO, H, KRA, MO, NCU, PH, SMU, UBC, UC, WA, W); Dubie-Dolina Raclawki, *M. Mazaraki* in 1948 (KRA); Stanowisko, Cienisty las, Myslenice, *K. Potyra* in 1959 (KRA); Jorfowisko, Gryfice, *K. Poulkouska* in 1950 (WA); Dublinach, *M. Raciborski* 150 (L, W); Jura, Krak-Wielunska, *Z. Radwanska s.n.* (WA); Gorce-Rezerwat Orkana, *St. Pelc* in 1954 (KRA); Beskid Niski, Cergowa Gora, *T. Tauk* in 1955 (KRA); Wadowice Dist., Kalwaria Zebrzydowska, *J. Trela, Pl. Exs. Pol.* 349 (L, MT, WA); Wadowice Dist., Lanckorona, *J. Trela, Pl. Exs. Pol.* 349 (DS, L, MO, MT, WA); Mt. Pieniny, Sokolka, *J. Walas, Pl. Exs. Pol.* 349 (DS, KRA, L, MO, MT, WA); Osim, Swiece, Mizunsa, *D. Woloszezak* in 1890 (W); Rybnik, *Ziesche, Fl. Sil. Exs.* 603 (WA).

PORTUGAL. Matasinhos, Ponte de Pedra, *J. Castro* in 1941 (MA); Serra do Gerez, S Bento da Porta Alberta e Covide, *R. Fernandes & F. Sousa* 2625 (DAO, UT); Quinta da Teneria, near Ponte Pedrinha, *A. Fernandes et al.* 5365 (TUR, UT); Lloula, Alfochiera, *R. Fernandes & F. Sousa* in 1948 (UT); Minho, Braga, Bom Jesus, *C. Fontes et al.* 9748 (MT); ca. 1 km N of Avanca, *J. Matos* 7591 (TUR); Melaco, S Gregorio, *A. Moller* 1377 (WU); near Espinho, between Espinho & Porto, *J. Paiva et al.* 7977 (TUR); Arouca, between Arouca and Sohnora da Guia, *J. Paiva et al.* 8252 (TUR); Minho, between Valenca & S Gedro da Torre, *M. da Silva* 60 (NCU).

ROMANIA. Moldavia, Bacau Dist., near Margineni, *N. Barabas & D. Mititelu* in 1970 (TUR, WA); Severin Dist., Bucharest, *P. Cretzoiu* in 1936 (MO); Tzahova near Linaia, *Desberger s.n.* (W); Brad, *Dunhoffer* in 1891 (WU); Baile Hurculane, *E. Häyren* in 1931 (H); Sinaia, *Leitlesberger* in 1897 (W); Ploesti Dist., Muntenia, near the town of Sinaia, *E. Lungenson* in 1963 (LD); Cotofanesti, Borseni, *D. Mititelu et al.* 42 (COLO, DAO, H, TUR, WA); Bals Dist., Oltenia, Oltet valley, *M. Paun* 357 (DAO, H, KRA, LD, WU); Transsilvania, Cluj Dist., *I. Prodan* 1298 (H, MO, UC, US, W, WA).

SPAIN. Pineta, Campo, *Antiguo s.n.* (MA); Coruna, Santiago de Compostela, *F. Bellot* in 1945 (MA); Santander, Espinama, rio Deva, *F. Bellot & B. Casaseca* in 1961 (MA); Fuente, Espinama, *F. Bellot & B. Casaseca* in 1961 (TUR); Pontevedra, *H. Buch* in 1930 (H); Caceras, Banos de Montemayor, *A. Caballero* in 1945 (MA); Lugo, Villardiaz-Fonsagrada, *E. Carreira* in 1953 (G, MA); Logrono, Canales de la Sierra, *B. Casaseca & F. Diez* in 1975 (MA); Pontevedra, Moana, Tiran, *S. Castroviego* in 1970 (MA); Navarra, Robledal de Garralda, *I. Caballos & A. Rodriguez* in 1960 (MA); Salamanca, Porto de Bajra, *J. Cogolludo* in 1914 (MA); Pirineo Orientale, Banos de Ribes, *Costa* in 1849 (MA); Villarrube, La Coruna, *F. Diez* in 1975 (MA); Louza, Alfocheira, *R. Fernandes & Sousa*

in 1948 (C); Quinta da Teneria, Rio Paivo, A. Fernandes et al. 5365 (C, LD); Oviedo, Junto a Canisquez, Sella R., E. F. Galiano et al. 1661/71 (G); Madrid, Guadarrama, B. Lazaro s.n. (MA); Avanca, ca. 1 km N, J. Matos 7591 (LD); Arredores de Melgaco, S Gregorio, A. Moller 1377 (LD); Navarra, Burquete, L. Nee 1784 (MA); between Espinho & Porto, J. Paiva 7977 (LD); between Arouca & Senhora da Guia, J. Paiva et al. 8252 (LD); Navarra, Roncesvalles, C. Pau in 1931 (MA); Pirineos Navarros, Valcarlos, V. Perez in 1907 (MA); Caceres, Hervas, S. Rivas-Goday in 1946 (MT); Orense, Castrelo de Mino, A. Rodriguez in 1935 (MA); Navarra, Alsasua, H. Roivainen in 1950 (H); Barcelona, Tibidabo Massif, F. Sennen 3936 (G, LD, MA, W); Santander, Espinama, C. Vicioso in 1944 (MA); Soria, Agreda, Sierra de Moncayo, C. Vicioso in 1935 (MA); Estrella, F. Welwitsch 782 (US).

SWEDEN. Skåne, Rödingekin, F. Areschoug in 1854 (W); Skåne, Öved, Blommeröd, E. Asplund in 1928 (MT); Skåne, Örup, E. Asplund in 1928 (MT); Skåne, Kullaberg, K. Bergman in 1890 (WTU); Skåne, Kullaberg, Bosjoklöster Parish, S. Blixt in 1967 (VPI); Öland, Vickleby, B. Boivin et al. 6988 (DAO); Skåne, Bälteberga, J. Braun in 1879 (MT); Skåne, Kragehalm, C. Duréu in 1866 (US); Öland Island, Great Alvar, between Vickleby and Lake Möckelmossen, F. Fosberg 32693 (US); Skåne, Fastorpskogen, R. F. Fristedt in 1865 (MO); Skåne, Hasslemölla, O. Hammar s.n. (W); Skåne, Ivö, C. Hammarlund in 1951 (COLO, MO); Skåne, E Sönnarslöv, Maltesholm, O. J. Hasslow in 1933 (MO); Skåne, Ballinga, S. Holmdahl in 1946 (TUR); Skåne, Landskrona, B. Holmgren in 1917 (W); Skåne, Torup, Slottspark, L. Ikkala in 1946 (H); Öland, Vickleby, O. Kohler in 1921 (MO, UC); Skåne, Paroecia Södra Sandby, Linnebjärshagen, N. Johnsson, Pl. Sue. Exs. 1222 (COLO, DAO, H, MTJB, NCU, RSA, W); Skåne, Kullen, J. Jonsson in 1891 (RM); Uddevalla, V. Kullgren in 1885 (H); Skåne, Svedala, A. Magnusson in 1879 (H); Skåne, Börringe, 1 km N of Havgård, K. N. Mattisson 1467 (DAO); Skåne, Torup, E. Rathsmann in 1968 (MO, SMU, UC); Göteborg, E. Rehnberg in 1888 (W); Västergöteland, Vänersnäs, Munkesten, J. A. Ryde in 1884 (MO); Bohuslän, Lyse Parish, Alsbäck, G. Samuelson in 1900 (NO, MT); Skåne, Horby, S. Selander in 1905 (WS); Skåne, Kullen, S. Selander in 1907 (TEX); Västergöteland, Halleberga, G. Svensson in 1937 (UC); Skåne, Helsingborg, G. Turesson in 1908 (H, TUR); Kulla Gunnarstorp, R. Wallengren in 1874 (H); Skåne, Brunby, W. Wallengren in 1885 (H); Skåne, Kullen, F. G. Widgrene in 1864 (UC).

SWITZERLAND. Basell, forest by Schauenburg, P. Aellen in 1932 (MO, NDA, UT); Eschenberg, G. Bachmann in 1892 (Z); Fribourg, F. Castella in 1904 (US); Zurich, Marthalen, L. Farrer in 1908 (Z); Höngger Berg, H. Grassmann in 1913 (UC); Ringgenberg, vicinity of Interlaken, Hegi in 1829 (US); Fribourg, Cernias, Jaques in 1903 (COLO); Schaffhausen, Guntmadingen, E. Kelhofer 1559 (Z); Aquila, R. & A. Keller in 1902 (Z); Zurich, W. Koch 39/625 (TUR); Clairiere, at the foot of Henberg, G. Kohler in 1919 (WTU); Appenzell-Innerrhoden, Büchaugabrüff, A. Koller in 1918 (Z); Vitznau on Lake Lucerne, G. Miller in 1904 (CAS, RM, US); Kusnacht, F. Oppliger 375 (Z); Vaud, Lausanne, P. Pfister in 1949 (US); Bex, Schleicher s.n. (MO, UC); Winterthur, Eschenberg, H. Siegfried in 1882 (Z); Chrischone, near Basel, T. L. Steiger in 1932 (NEB); Fribourg, Gruyeres, Cernias, T. Taquet in 1903 (Z); Geneva, Commune de Vandoeuvres, S. Vautier et al. 557 (DS, GA, MA, NCU, PH, RSA, SMU, TUR, UBC, UC, US, WS, WTU); Gsental in Pilatus, M. Vischer in 1910 (Z); Martigny, F. P. Wolf in 1886 (Z).

UNITED KINGDOM: ENGLAND. Knowsley, between Liverpool & Prescott, M. Atkinson in 1959 (W); Whitton, A. E. Baggs in 1910 (UBC); Windermere, Westmorland, J. Ball in 1876 (PH); Gloucestershire, St. Briavels, J. Ball in 1854 (US); Westmorland, Rydal, J. Ball in 1838 (IA); Cheshire, A. Bennett in 1883 (MTMG); Lynton, E. Brubaker 1949 (PENN); Surrey, 1 mi. NE of Dorking, R. Brummitt 60362 (W); Ambleside, R. Campbell s.n. (MTMG); Parkstone, Dorset, M. Cocke 12 (MTMG); Chislehurst, J. Cockerell s.n. (NMC); Marlow, Davenport Wood near V. C. 24, M. B. Gerrans 1357 (ASU, H); Isle of Wight, Harland s.n. (IA); Clovelly, E. & S. Harper in 1901 (US); Surrey, Morden Hall, C. Hartman in 1849 (W); Cheltenham, T. J. Hatton in 1830 (UMO); Cornwall, St. Anthony in Roseland, near Truro, G. Hayes 47 (W); Essex, Berechurch, S. T. Jermyn 229 (DAO); London, Regents Park, Y. Mäkinen in 1960 (TUR); Kent, Bromley, C. Marchant in 1955 (UBC); Surrey, Box Hill, A. Melderis & E. B. Bangerter 126 (DAO); Yorkshire, R. Middleton in 1858 (MTMG); Durham, R. Middleton in 1845 (MTMG); Cambridge, J. H. Newton in 1965 (NCU); Surrey, Cooper's Hill, Runnymede, D. Philcox 2152 (ASU, SMU); Addingsham, F. Rhodes in 1906 (PENN); Cornwall, Penzance, N. Taren in 1961 (TUR); Wickham, Hants, T. M. C. Taylor 5560 (UBC); Cornwall, Lostwithiel, E. Thurston in 1929 (MO, US); York, Wetherby, G. Webster in 1879 (MIN); Bristol, Clifton, J. White in 1929 (CAS, SMU); Middlesex, Tottenham, B. Wurzell 973 (MO). IRELAND. Limerick County, W. Cleburne in 1882 (NEB); Kerry County, Killarney, Muckcross Estate, P. Halliday 55 (DAO); 5 mi. W of Sligo, S side of Knocknarea, The Glen, A. C. Jermy 1476 (RSA); Killarney, Ross Island, H. Lindberg in 1932 (H); Galway County, Lough Derg, A. E. Lomax in 1886 (DS); Dublin County, Lucan?, M. O'Leary in 1939 (SMU, TUR); Wicklow County, Devil's Glen, M. Scannell in 1950 (H); Meath County, River Boyne, Donore, Drogheda, D. Synnott in 1963 (TUR). SCOTLAND. Tyfe, J.



*Cruickshank* in 1837 (US); Aberdour, *Gunn* 138 (UBC); near Abbotsford, *I. M. Hayward* in 1912 (OKLA); Midlothian, The Yore, Yorebridge, *J. Sinclair* 2346 (NCU); Arran Island, *Wrightshar* in 1861 (UC); Lanark, without collector in 1872 (E). WALES. Arthog, Merionethshire, *P. Benoit* in 1953 (MT); Tregwynt, *R. Campbell* in 1890 (MTMG); Glamorganshire, *R. L. Smith* in 1928 (OKL); Porthkerry, Glamorgan, *A. E. Wade* in 1937 (B).

YUGOSLAVIA. Serbia, Knjazewac, *Adamovio* in 1896 (WU); Serbia, Kopaonik, *M. Dimitrijin* in 1883 (WU); Serbia, Rtanj, *M. Dimitrijin s.n.* (WU); Slavonia, Papok Mts. near Pozega, *A. Ginzberger* in 1910 (WU); Serbia, Nakrivanj, *G. Ilic* 1184 (WU); Serbia, Nisch, *G. Ilic* 1090a (WU); Croatia, Crnopac, *E. Janchen* in 1907 (WU); Bosnia, Plitvice, *H. Lenander* in 1938 (RM); Herzegovina, Nevesinje, *H. Raap* 176 (H, LD, US, WU); Bosnia, Hsan, *J. Schiller* in 1903 (WU); Croatia, Plitvice, *J. Schiller & M. Stark* in 1902 (WU); Serbia, Beograd, *T. Wisniewski & H. Sliwinska* in 1927 (WA).

#### AFRICA

ALGERIA. Without locality, *J. A. Batandier s.n.* (G); Oran, *E. Bjorling* in 1882 (L); Blivah, Chiffa Gorge, *E. Cosson* in 1854 (GH, MO, W); Foot of Oved, Guelil, near Grotte Marveilleuse, *Davis* 52838 (RNG).

TUNISIA. Ain Draham, *Thebault* in 1910 (G).

#### U.S.S.R.

ARMENIAN S.S.R. Surnuchi, Uzen-Mesa, *A. Schelkovnikov & E. Kara-Murza* in 1929 (LE); Kasrapekeiy Region, *Zpuzopan* in 1959 (W). AZERBAIJAN S.S.R. Kuba, near Kusary, *S. Grigoriev* 8 (DS); Hzejbedzanskaya, Zanabatskyi, 9 km from Zaradat, *I. Ilinskaja* in 1946 (LE); Langelan, between Ordaklyu and Sabu, *Y. Karjagin & A. Chadarin* in 1932 (S); Lenkovanskyi Dist., Alekseevka, *M. I. Kurmoshkin* in 1936 (LE). BELORUSSIAN S.S.R. Minsk Prov., Czervenski, Igomenski, *Savicz et al.* in 1930 (MW). GEORGIAN S.S.R. Mekvena, at the Riova R., *A. & V. Brotherus* in 1877 (H); Caucasus, between Tkue & Kosekha at Didi Liachva, *A. & V. Brotherus* 342 (BM, H (mixed sheet with *C. alpina* and *C. × intermedia*)); Caucasus, S Osetiya ("Osebia"), near Falkudschin, *E. & N. Busch* in 1928 (S); Abkhasia, Sukhumi, *P. H. Davis* 33672 (K); Adzhariya, *A. Dimitrieva* in 1965 (NA); Abkhazskaya, Gareiniskiy Khrebet, *C. R. Frazer Jenkins* 2906 (BM); Kutaiskaya, Guri, *E. I. Kikodse* in 1914 (GH); Caucasus, Batum Dist., Zelenom Misu, *P. N. Krilov & E. I. Steinberg* in 1916 (LE); Tzebeld Dist., Azbijanskyi, *J. Menitzkyi* 197 (LE); Transcaucasus, Cartalinia, Borshom, *Olearski* in 1909 (DS); Caucasus, Abkhazia, Tsebeldie, Terjevskoya, *Voronova* in 1905 (S, US). LITHUANIAN S.S.R. Kaunas, B. Hryniewiecki in 1929 (WA). MOLDAVIAN S.S.R. Strashensky region, *A. Borisova* 1520 (DAO); Strashensky, Kupriani, *A. Borisova* 1520a (MW); Korneshty, upper Redjanski valley, *A. Borisova* 1681 (MW); Ungenski Dist., St. Redeni, *E. Lipovaya* in 1959 (A, H). RUSSIAN S.F.S.R. Yaroslav, Rybinski, Kameniki village, Niznenikulski, *B. A. Fedchenko et al.* in 1923 (MW); Moscow Dist., Kuntzevo, *M. Koshevnikova* 817 (H, MW, W, WA); Kostroma Prov., Nerehtsk, Vasilevo, *K. K. Kossinsky* 819 (MW); Soczi Dist. Krassnaya-Polyana, *D. Litvinov* 213 (G, H, LE, W, WA, WU); Kaliningrad Prov., Kresno Armenskaya, *A. Poledimova & Czerepatov* 535 (MW); Kuban R., *Poltaintsay* in 1889 (WU); N Caucasus, Maykop, *N. Shestounow* 1220 (NY); Penza Prov., Mokshansk, *Sprygin* in 1909 (MW); Mts. near Moscow, *Tchikorsky s.n.* (W). UKRAINIAN S.S.R. Krym, Czatyrdag Mt., *E. O. Belanskaya et al.* in 1968 (MW); Mukachevo, *V. Grubov & E. Rachkovskaya* in 1949 (DS); Transkarpat, opposite city of Perechin, *K. N. Igoshina & A. A. Benken* in 1951 (MW); Volinsk, Kremenets, *A. I. Micholson* in 1916 (MW); Transcarpatia, Rachov Dist., *G. Ogureena* in 1959 (MO); Bila Tzerkova Dist., Luka, *E. Palonska* in 1929 (S); L'vov (Lyvov) Prov., Czertova Mts., Virniki, *A. I. Pojarkova et al.* in 1940 (MW); Krym, Romanovskaya Highway, *H. Poplawska* 883 (MW); Krym, Mt. Tschatyrdagh, *V. Siplivinski et al.* in 1968 (MO); Krym, Buka, between Mts. Demordnis & Tschartyrdagh, *A. K. Skvortsov* in 1967 (MO); Transcarpatia, Veli-ki] Berezny, *A. K. Skvortsov* in 1968 (MO); Krym, Mons Babugan, *A. K. Skvortsov* in 1969 (MO); Transcarpatia, Mukascherv, *A. K. Skvortsov* in 1969 (MO).

#### ASIA

IRAN. Mazanderan, S of Amol, *J. C. Archibald* 2287 (K); Ghilan, *Aucher-Eloy* 4909 (BM, G, P, W); W Elburz, N side of Kandevan Pass, *Bowles Bot. Exped.* 2258 (K); Khurasan, 80 mi. ENE of Gorgan near Bojnurd Road, *Furse & Synge* 523 (K); Mazanderan, 8 km S of Chalus, *M. Grant* 16494 (NA); Mazanderan, Gozlu, *W. Koelz* 16237 (US); Guilan, Lahijan, *N. Lindsay* 863 (BM, MO); Rosht, *H. Pravitz* 957 (S); Mazanderan, Chalus R. valley, *K. Rechinger* 2066 (US); Ostan 2, Khozlok & Gurgan, *F. Schmid* 6021 (G); between Gagan & Bojnurd, without collector 3997 (K); Mazanderan, Haraz valley, Karehsang, *P. Wendelbo* 1515 (DS).

SYRIA. Mt. Amanus, *M. Haradjian* 158, 4582 (G), 234 (G, K); Amanus, Mt. Dumauly, *M. Haradjian* 3733 (G).

TURKEY. Kilidjounar, Bagtchekeuy, *G. V. Aznavour* in 1900 (G); between Beycos & Akbaba, *G. V. Aznavour* in 1890 (G); Findiksou, *G. V. Aznavour* in 1899 (G); Sariyer, Kastanesouyose, *G. V. Aznavour* in 1895 (G); Findik & Kestane Souyou, *G. V. Aznavour* in 1895 (G); Lazistan, Rhize, *B. Balansa* in 1866 (G, K); Rize, Hemsin, Meydan Kobaca, Mollaveysa, *P. H. Davis* 21381 (BM); Uniye, Uniye-Karakus, *P. H. Davis & O. Polunin* 24919 (BM, K); Coruh (Artvin), Savval Tepe, Murgul, *P. H. Davis & I. C. Hodge* 32216 (BM, K); Zonguldak, Tefenni to Yenice, *P. H. Davis et al.* D37755 (K); Trabzon, Bos Tepe, *F. Handel-Mazzetti* 200 (W); Alma Dag, *M. Haradjian* 158 (W); Istanbul, Belgrad Ormani, *B. Kasaplyrl* 564 (UC); Amasya, Akeziwan, *Manisadjan* 201 (K, S); Bolu, Adapazari (Sakarya)-Bolu, *McNeill* 240 (K); Polonezkay, *B. V. D. Post* in 1939 (G); Rize, Black Sea, *B. V. D. Post* 2020 (G); Thrace, Ketcheli, *H. G. T.* in 1930 (K); Black Sea coast, ca. 20 mi. W of Trabzon, *P. Votila* 19863 (H).

Plants intermediate between *Circaea lutetiana* L. subsp. *lutetiana* and *C. lutetiana* subsp. *quadrisulcata* (Maxim.) Asch. & Mag.:

AUSTRIA. Osttirol, SE of Dolsach, *A. Polatschek* in 1976 (W).

U.S.S.R. BELORUSSIAN S.S.R. Vitebsk Prov., vicinity of Vasuty, *N. Koslovskaja* 597 (MW). LATVIAN S.S.R. Duna R., near Kokenhusen, *Bruttan* 272 (MW). RUSSIAN S.F.S.R. Ufa Prov., vicinity of Durrassowo, *I. Schirajewsky* in 1907 (MW). UKRAINIAN S.S.R. Mogilev Prov., between Mogilev & Borysthenem, *N. Downar* in 1862 (MW); Chernigov Prov., vicinity of Starodub, *Rogovich s.n.* (MW).

*Circaea lutetiana* subsp. *lutetiana* can be distinguished by the presence of an exerted, nectar-secreting disc, the bilocular, clavate to obovate fruits that lack prominent ribs and sulci, by the pubescent stems, and by a generally longer, more slender floral tube than in other species of the genus.

*Circaea lutetiana* subsp. *lutetiana* differs from subsp. *canadensis* and *quadrisulcata* in dimensions and morphology of the fruits and in length of the floral tube, although there is some overlap in the latter character. *Circaea lutetiana* subsp. *canadensis*, in addition to its isolated range from the other two subspecies, almost always has a minute bracteole at the base of the pedicels. Both *C. lutetiana* subsp. *canadensis* and subsp. *quadrisulcata* tend to have glabrous stems but occasional plants of subsp. *quadrisulcata* have a few, widely scattered falcately recurved hairs on the upper internodes. *Circaea lutetiana* subsp. *lutetiana* commonly has ovate leaves while the leaves of subsp. *canadensis* and *quadrisulcata* are more consistently oblong ovate.

Numerous infraspecific taxa have been proposed (see synonymy) to account for the variability that occurs within *Circaea lutetiana* subsp. *lutetiana* but these names have been based primarily on studies undertaken in limited geographical areas and have not taken into account plants from throughout the entire range of the subspecies. When this is done, it is clear that the numerous subspecies, varieties, and forms do not exhibit any geographical or ecological pattern and do not warrant formal taxonomic recognition. Relatively few specimens have been examined during this study, but a selection is cited here.

The presence of bracteoles, which Ascherson and Magnus (1870) used to describe *Circaea lutetiana* subsp. *mediterranea*, as with other characters, is highly variable. Plants with bracteoles do not occur exclusively within a well-defined geographical area although plants with bracteoles tend to be more common in the region around the Mediterranean. Raven (1963) found no plants of *C. lutetiana* with bracteoles from the British Isles. In *C. lutetiana* subsp. *lutetiana*, bracteoles,

TABLE 1. Comparison of *Circaea lutetiana* subspp. *canadensis*, *quadrisulcata*, and *lutetiana*.

		<i>C. lutetiana</i> subsp. <i>lutetiana</i>	<i>C. lutetiana</i> subsp. <i>canadensis</i>	<i>C. lutetiana</i> subsp. <i>quadrisulcata</i>
Pedicel	flower	2–9 mm	2–6 mm	1.9–4(–5*) mm
	fruit	3.8–10 mm	3.5–6.5 mm	3.5(–6.3*) mm
Bud	length	2.4–5.4 mm	2.3–4.1 mm	2.6–3.8 mm
	width	1–1.9 mm	1.2–2.3 mm	1.1–1.5 mm
Ovary	length	1.1–2.2 mm	1.2–1.7 mm	1–1.7 mm
	width	0.9–1.5 mm	0.8–1.3 mm	0.8–1.1 mm
Floral tube	length	0.8–2.4 mm	0.4–1.2 mm	0.6–1 mm
	width	0.1–0.3 mm	0.2–0.3 mm	0.2 mm
Sepals	length	1.6–4.5 mm	1.9–3.8 mm	1.3–3.2(–3.5*) mm
	width	0.8–2 mm	1.2–2.4 mm	1–1.7 mm
Petals	length	1.4–3.5 mm	1.3–2.9 mm	1–2(–2.5*) mm
	width	1.8–4 mm	1.5–4 mm	1.4–2.5 mm
Apical notch		0.6–2.4 mm	0.4–1.7 mm	0.4–1.2 mm
Filaments		2.5–4.3 mm	1.2–2.8 mm	1.6–3.5 mm
Anthers	length	0.6–1 mm	0.6–0.8 mm	0.3–0.7 mm
	width	0.3–0.9 mm	0.5–0.8	0.3–0.5 mm
Style		3.3–6 mm	2.2–5.5 mm	1.8–4.2 mm
Stigma	length	0.2–0.6 mm	0.2–0.4 mm	0.2–0.4 mm
	width	0.4–0.9 mm	0.3–0.6 mm	0.3–0.6 mm
Fruit	length	2.8–3.8 mm	2.8–4.5 mm	2.2–3.8 mm
	width	1.4–2.4 mm	1.9–3.6 mm	1.8–3(–3.4*) mm
Pedicel + fruit		6.3–15 mm	6.3–11.2 mm	4.3–8.5(–10*) mm
Leaf	length	3–15 cm	5–16 cm	4.5–12 cm
	width	2–12 cm	2.5–8.5 cm	2–5 cm
Petiole		0.6–7.5 cm	1.3–5.5 cm	1.5–5 cm
Disc	length	0.2–0.6 mm	0.3–0.7 mm	0.2–0.6 mm
	width	0.3–0.9 mm	0.6–1.1 mm	0.5–1 mm
Fruit shape		clavate to obovoid	pyriform to subglobose	pyriform to subglobose
Stem pubescence		usually dense	glabrous	glabrous to very sparse

\* Measurements from plants collected north of the Altai Mountains in central Siberia.

when present, are often restricted to the lowermost pedicels or, if present at the base of all pedicels, are deciduous before maturation of the fruit. Only rarely are bracteoles somewhat persistent below all pedicels of an inflorescence. Table 1 compares the subspecies of *C. lutetiana*.

##### 5. *Circaea erubescens* Franchet & Savat., Enum. Pl. Jap. 2: 370. 1879.—FIG. 15.

*Circaea delavayi* H. Lév., in Fedde, Rep. Nov. Sp. 8: 138. 1908. TYPE: China, Sichuan, Chien-feng-shan, forests of high mountains, August 1894, *J. M. Delavay 5021* (G, lectotype; DS, G, P,

isolectotypes). The label data on Delavay's collection is "Yunnan, Tchen-fong-chan." The only name in the area of this collection that approximates the pronunciation of Delavay's "Tchen-fong-chan" is Chien-feng-shan in southern Sichuan, just south of the Yangtze River, but near northeastern Yunnan.

*Circaea lutetiana* L. race *erubescens* (Franchet & Savat.) H. Lév., Bull. Acad. Int. Géogr. Bot. 21: 219. 1912.

*Circaea kawakamii* Hayata, Icon. Pl. Formos. 5: 71. 1915. TYPE: China, Taiwan, T'ai-tung Hsien, Mt. Hito-shan ("Ritozan"), August 1913, T. Kawakami (TAIF 18267, lectotype; TI, isolectotype; A, US, photograph).

Erect, or decumbent at the base and rooting at the nodes, 1–12 dm tall, simple or freely branched above, forming numerous, sometimes branched, rhizomes without tuberous thickenings that give rise to the following year's plants from their tips. Plants glabrous or, in some plants from Japan and from Cheju-do (Quelpaert Island), Korea, the stem finely pubescent with soft, short, falcately recurved hairs, 0.1–0.2 mm long, these continuing along the petioles, where the hairs are upwardly curved, to the under, and sometimes also the upper, surface of the leaves. Nodes, rarely the entire stem, deep reddish-purple. Leaves horizontally spreading, commonly reddened between the veins, opaque: those between the middle and upper part of the stem the largest, (2.5–)4–8(–10) cm long, (1–)2.3–4.5(–6) cm wide, becoming gradually to abruptly reduced in size upward and eventually bractlike and opposite or subopposite, rarely alternate, in the lower part of the inflorescence, gradually reduced in size downward; lanceolate to ovate or occasionally broadly ovate, short acuminate at the apex, very broadly cuneate to rounded or truncate, rarely subcordate, at the base, denticulate. Petioles (0.6–)1.5–4(–6) cm long, terete or semiterete, often with reduced branches arising in the axils. Inflorescence glabrous, a simple terminal raceme or, more commonly, with additional racemes at the tips of the uppermost axillary branches; the racemes simple or, more commonly, branched at the base, the branches alternately or oppositely arranged, subtended by reduced leaves or leaf-like bracts. The terminal raceme, from the uppermost reduced leaf or leaf-like bract, ca. 2 cm long at initiation of flowering, to 20 cm long at cessation of flowering, the lateral racemes ca. 2 cm long at initiation of flowering, to 17 cm long at cessation of flowering, the lateral branches often of unequal lengths on the same plant. Flowering pedicels (1.5–)2.5–5.5(–7) mm long perpendicular to the axis of the raceme, without, less commonly with, a minute, setaceous bracteole, 0.1–0.4 mm long, at the base which is usually deciduous before maturation of the fruit. Fruiting pedicels 4–8.5 mm long. Buds glabrous, reddish-purple, narrowly elliptic to oblong or oblanceolate in outline, gradually tapering to abruptly short or long acuminate at the apex; from the summit of the ovary, 2.4–3.2(–3.6) mm long, 0.8–1.5 mm thick just prior to anthesis. Ovary 0.7–1.2 mm long, 0.5–0.9 mm thick at anthesis, narrowly to broadly obovate in outline, densely pubescent with translucent, soft, uncinuate hairs. Floral tube 0.5–0.8 mm long, ca. 0.2 mm thick at the narrowest point, cylindrical or narrowest at the middle and dilated at both ends. Sepals 0.6–2.5 mm long, 0.8–1.2 mm wide, glabrous, reddish-purple, oblong to lanceolate, abruptly short to long acuminate, reflexed in flower. Petals 0.8–1.7 mm long, 0.7–1 mm wide, longer than wide, pink, narrowly to broadly obtrullate or obovate in outline; the apical notch 0.1–0.3 mm deep,  $\frac{1}{10}$ – $\frac{1}{5}$  the length of the petal; the petal lobes very minutely crenulate or with minute secondary lobes, closely spaced; the petals tapering smoothly to the base. Stamens spreading at anthesis or rarely one, very rarely both, appressed to the style; shorter than the

style; filaments 1.4–2.3 mm long; anthers 0.4–0.7 mm long, 0.2–0.5 mm thick. Style straight, erect or slightly drooping at the apex, 2.2–3 mm long, topped by an obtriangular to transversely oblong stigma, 0.1–0.4 mm tall, 0.3–0.5 mm thick. Nectary exerted as a conspicuous, fleshy, cylindrical disc, 0.2–0.5 mm tall, 0.3–0.6 mm thick. Mature fruit 1.7–3.2 mm long, 1.2–2.1 mm thick, bilocular and 2-seeded, obovoid to broadly so, very slightly flattened dorsally, broadly rounded at the apex, tapering smoothly to the pedicel, without prominent ribs or sulci but with a narrow groove representing an extension of the pedicel; densely covered with stiff, translucent, uncinuate hairs, ca. 0.6 mm long, and with fewer, shorter, capitate and clavate-tipped glandular hairs ca. 0.1 mm long. Fruiting pedicels slightly to sharply reflexed. Combined length of pedicel and mature fruit, (6–)7.5–12 mm long. Gametic chromosome number,  $n = 11$ .

TYPE: Japan, Kanagawa Prefecture, Mt. Hakone, August 1866–1874, *P. Saviatier 413* (P, holotype).

Distribution (Fig. 14): Rocky streambeds and seepages, along trails and road banks and rich alluvial woods in temperate deciduous forests. Japan, except Ryukyu Islands and islands south of the Kyushu mainland; South Korea; China, from Jiangsu and Zhejiang westward along the Yangtze River and its tributaries to southern Sichuan, Yunnan, and Guizhou; Taiwan. From near sea level to 2,500 m. Flowers, from mid-June through August and sporadically to mid-September.

Representative specimens examined:

#### U.S.S.R.

RUSSIAN S.F.S.R. The single specimen from the Soviet Union, Siberia, above Kulsuk (Kyrmykr), at the middle part of L. Baikal, *S. J. Enander in 1913* (S), is obviously the result of mixed collections. Enander visited Japan during the same year and presumably collected this specimen there. Other reports of *Circaea erubescens* from Sakhalin have been clarified by Skvortsov (1979), who pointed out that those collections are *C. × intermedia*.

#### ASIA

CHINA. ANHUI: Huang Shan, *R. C. Ching 4178* (UC), 8567 (US); W Siunin, Ma-che, *R. C. Ching 4460* (UC), 8840 (US); Huang Shan, *K. S. Chow 486* (PE); Jinzhai Hsien, *Colleagues Bot. Inst. E China Sta. 6780* (PE); Hiu Keou, *P. Courtous 37725* (NAS); Huang Shan, *L. K. Fu 748* (NAS, PE); Jinzhai, *Stat. Bot. Est. China 6780* (NAS). FUJIAN: Wuyi Shan, *C. P. Tsieng 401002* (PE). GUANGDONG: Ruyuan Hsien, *X. G. Li 201148* (PE). GUIZHOU: Lung-li Mts., *J. Cavalerie 3840* (E, K, P); Fangching Shan, *C. Y. Chiao & C. Cheo 454* (NAS); Yinchiang Hsien, *T. P. Chien 31709* (PE); Jungchiang Hsien, *T. P. Chien 51787* (PE); Rongjian, *Exped. S Guizhou 3269* (NAS); Fanjing Shan, *Guizhou Exped. 1675, 2222* (PE); Ta-ho-yen, Mt. Fanjing Shan, *A. N. Steward et al. 454* (E, GH, L, NY, PE, S, US); Ma-tsoong-ling, Tuyun, *Y. Tsiang 5785* (NAS, NY, W); Tuyun, *Y. Tsiang 5998* (NAS, NY, W); Sihfeng, *Y. Tsiang 8126* (NAS). HUBEI: Lichuan Dist., Suisapa (*Metasequoia* area), *W. C. Cheng & C. T. Hwa 842* (K, UC); Jianshi Hsien, *L. Y. Dai 1301* (PE); Badong Dist., Yichang, *A. Henry 4743* (LE); S Badong, *A. Henry 7279* (K, LE); Hegeng Hsien, *H. J. Li 5787* (PE). HUNAN: Nanyuen, *Y. Liu 168* (NAS); "Hunan," *S. Z. Sin 236* (PE). JIANGXI: Shangyou Hsien, *T. L. Chia 521, 70533* (PE); Lu Shan, *Y. K. Hsiauog? 6727* (NAS), *H. H. Hu 2473* (PE); Lu Shan-Kuling, *A. N. Steward 963* (UC); Lu Shan, *M. J. Wang 842* (NAS). JIANGSU: Nanjing, *Macklin 33a* (GH). SHAANXI: Foping Hsien, *K. T. Fu 5076* (PE). SICHUAN: Wan Hsien, *W. C. Cheng & C. T. Hwa 842* (PE); Chengkuo Hsien, *T. L. Dai 101845* (PE), 104641 (NAS, PE); "Tchen-fong-chan," *J. M. Delavay in 1893* (MO, P, US), 5176 (DS, G, P); Mt. Emei Shan, *E. Faber 71* (K, US), 303 (MO, P), *W. P. Fang 3138* (E, K, P, PE, US); Ebian Hsien, *Y. Y. Ho 6487* (NAS); Shimian Hsien, *C. C. Hsieh 42284* (PE); Nanch'uan Hsien, Chin-shan t'eh-wa-shih, *C. H. Hsiung & T. L. Chou 92747* (PE); Nanchuan Hsien, *K. F. Li 62928* (NAS, PE); Opian Hsien, *C. L. Sun 946* (US); Mt. Emei Shan, *S. C. Sun & K. Chang 878* (A); Hanyuan Hsien, *T. P. Wang 8652, 8820* (PE); Nanchuan Hsien, *J. H. Xiong 91837, 92109, 92374, 92747* (PE); Emei Hsien, *K. H. Yang 56347* (NAS, PE); Ebian Hsien, *Z. W. Yao 2872, 3002*

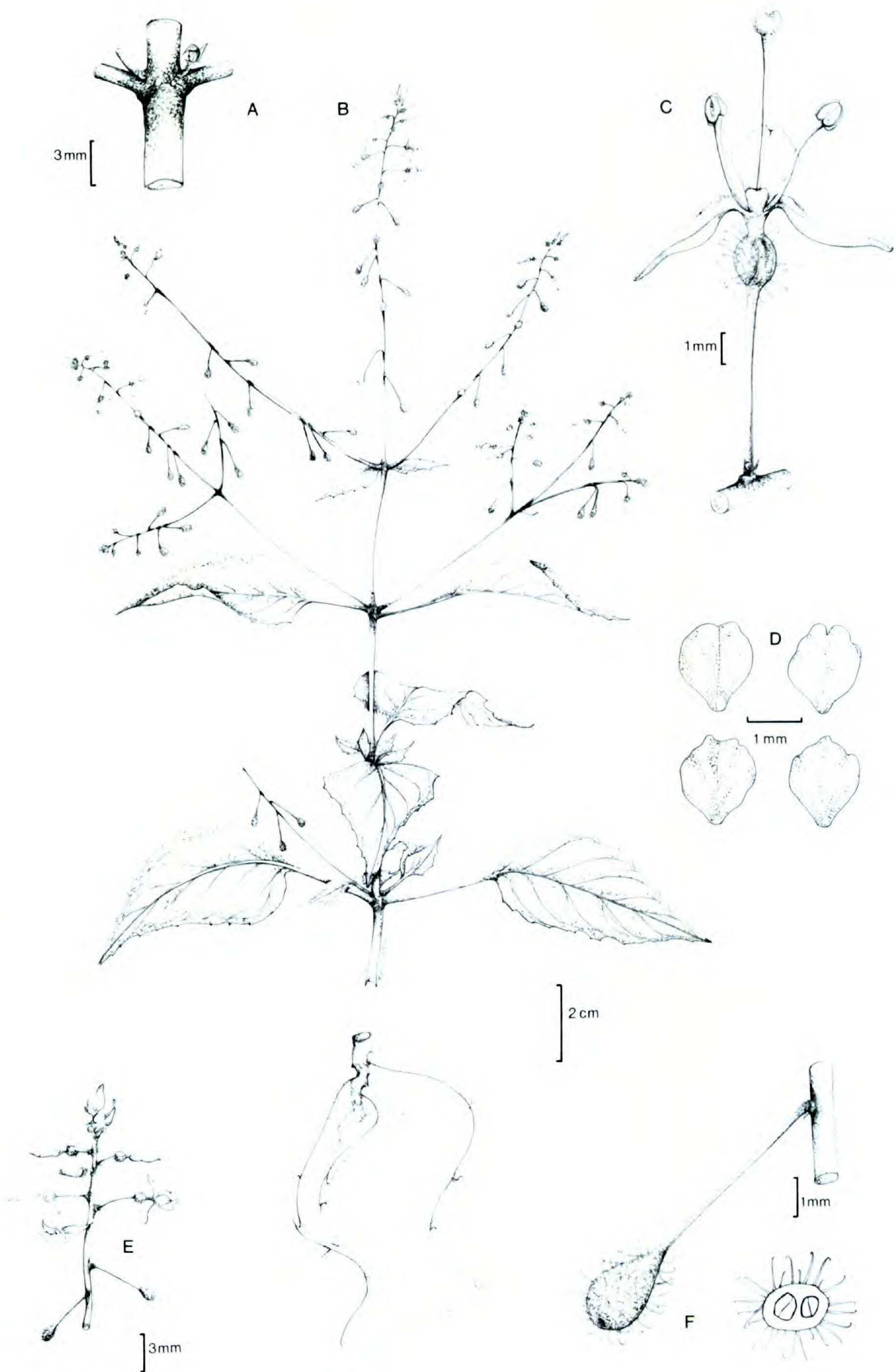


FIGURE 15. *Circaea erubescens* Franchet & Savat.—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note exserted nectary.—D. Variation in petals.—E. Inflorescence.—F. Fruit. From Boufford & Wood 19860 (KYO, MHA, MO).

(PE), 4531 (NAS, PE). TAIWAN: Kwarenko-cho, Tyuosen-zan, Rodohu-tobe, *Fukuyama & T. Suzuki in 1936* (TAI); Hsinchu Hsien, Kwan-wu, Chuton Logging Station, *T. C. Huang 4142A* (TAI); Hualien Hsien, Luan Shan, *T. C. Huang 4142A* (TAI); Ilan Hsien, Mt. Nan-ko-tai-zan, *Kojima & Shiomi 2025* (KYO); Mt. Rara, *E. Matuda in 1918* (TI, UC); Taipei Hsien, Uusan (Wu-shan?), *E. Matuda in 1918* (TAIF); Ilan Hsien, Mt. Nan-ko-tai-zan, *J. Ohwi in 1933* (KYO), 3910 (K, TNS); Taitung Hsien, Mt. Rito, *S. Sasaki in 1913* (TAI); Hsinchu Hsien, Taiping Shan, *S. Sasaki in 1915* (TAIF); Ilan Hsien, "Nan-hu-ta-shan," *S. Sasaki in 1922* (TAI, TAIF); Hsinchu Hsien, Mt. Yura, *Y. Simada 2059* (TI), 2423C (TAI), 2423D (NTUF); Ilan Hsien, Mt. Nankotaizan, *S. Suzuki in 1922* (KAG); Taiheizan, *S. Suzuki in 1928* (NAS), *in 1929* (GH); between Matomine & Hakko, *S. Suzuki in 1930* (PE); Mt. Taiheizan, *S. Suzuki 1107* (PE); Sanyaku & Suigen, *S. Suzuki 5941* (TAI); Nantou Hsien, from Ali Shan to Hoshe, *M. Tamura et al. 22237* (S, SHIN); Hualien Hsien, Mei-ma-wang-shan, *S. Ying 1306* (NTUF); Hsinchu Hsien, Mt. Tai-ping-shan, *without collector in 1929* (TAI); Xinzhu Zhou, *without collector in 1932* (NAS). YUNNAN: Daguang Hsien, *NE Yunnan Exped. 192* (PE); Yiliang, *NE Yunnan Exped. 851* (KUN). ZHEJIANG: Mt. Tientai Shan, *C. Y. Chiao 14465* (E, UC, US); Hsi-tienmu Shan, *H. C. Chu 238* (NAS), *Exped. Pl. Res. Zhejiang 29470* (NAS); Tiantai, *Exped. Pl. Res. Zhejiang 28118* (NAS); Hsi-tienmu Shan, *Y. Y. Ho 678, 22450, 25307, 54587* (NAS); Changhua, *Y. Y. Ho 23921* (NAS); Tianmu Shan, *K. C. Kuan 75450* (PE), *T. N. Liou 6959* (NY, PE); Mt. Hsi-tienmu Shan, *H. Migo in 1935* (TI); Tianmu Shan, *H. Migo in 1935* (PE), *K. K. Tsoong 621* (PE); "Chekiang," *without collector 20168* (WH).

JAPAN. HOKKAIDO: around Hakodate, *Albrecht in 1861* (LE); Sapporo, *S. Arimoto in 1902* (MO); Hidaka, Shizunai-cho, ca. 14 km ENE of Shizunai, *D. E. Boufford & E. W. Wood 19676* (BM, CM, G, K, KYO, LD, MHA, MO, NCU, PE); Hidaka, Samani-gun, Samani-cho, Okada, *D. E. Boufford & E. W. Wood 19690* (BM, CM, G, GH, K, KYO, MHA, MO, NCU, PE, TUS); Kushiro, Kawakami-gun, Shibeche Experimental Forest of Kyoto Univ., *D. E. Boufford & E. W. Wood 19764* (CM, E, K, KYO, MHA, MO, PE, UC); Abashiri, Yubetsu-cho, 1.6 km E of Engaru-cho on hwy 147, *D. E. Boufford & E. W. Wood 19796* (CM, K, KYO, MHA, MO, PE); Kawakami, hwy 40 just WNW of Osashima, *D. E. Boufford & E. W. Wood 19835* (MO); Sorachi, Ashibetsu city, along the Hachigatsugawa R., *D. E. Boufford & E. W. Wood 19854* (BM, C, CM, G, GH, K, KYO, LD, MHA, MO, NCU, P, PE, TUS); Ishikari, Sapporo city, *D. E. Boufford & E. W. Wood 19860* (KYO, MHA, MO); Poronai, *W. P. Brooks in 1884* (UC); Hakodate, *U. Faurie 1339* (KYO); Horobetsu, *U. Faurie 2631* (KYO, P); mountains of Sapporo, *U. Faurie 3165* (P); Hidaka, Saruru, *T. Fujita & E. Nakagawa in 1955* (TUS); Ishikari, Sorachi-gun, Manju, *F. C. Greatrex in 1915* (SAP); Oshima, Narukagawa valley, *F. C. Greatrex 339* (SAP); Shiribeshi, Mt. Karibu, *F. C. Greatrex 339a* (SAP); Hidaka, Shoya, *H. Hara in 1934* (ORE); Hidaka, Horoizumi, Shoya, Maruyama, *H. Hara et al. in 1974* (TI); Toyobishi, *S. Hori s.n.* (SAP); Ishikari, Mt. Yubari, *R. Ishida in 1928* (UC); Kushiro, Mt. Meakan, *T. Kawakami in 1897* (SAP); Teshio, Kami-otoineppu, *G. Koidzumi in 1930* (KYO); Hidaka, Shizunai-gun, from Petakari-sanso to the base col of Mt. Petakari, *H. Koyama & N. Fukuoka 3257* (KYO); Mororan, *T. Makino in 1899* (COLO); Toya-mura, Iburi-ko, *T. Makino s.n.* (KAG, MAK 6945, S); Shiribeshi, Okushiri Island, *S. Matsuda 876* (KYO); Moiwa, *S. Matsumura in 1899* (TI); Ishikari, Sapporo, *K. Miyabe in 1882* (PH); Oshima, Ichinowatari-sanchu, *K. Miyabe & Y. Tokubuchi in 1890* (SAP); Oshima, Shiriuchi-sando, *K. Miyabe & Y. Tokubuchi in 1890* (SAP); Shiribeshi, Okushiri, *K. Miyabe & Y. Tokubuchi in 1890* (SAP, TI); Sapporo, *K. Miyabe in 1891* (GH, MO); Ishikari, Sorachibuto, Sorachi, *K. Miyabe in 1891* (PH, SAP, TI); Iburi, Chitose, *K. Miyabe & S. Arimoto in 1902* (SAP); Mt. Moiwa, *M. Mizushima in 1943* (TI); Sapporo city, Mt. Maruyama, *M. Mizushima 2604* (TI); Oshima, Mt. Sengen-dake, *K. Munakata in 1960* (MASS, MHA, MO); Ishikari, Nopporo, *G. Murata 8996* (KYO); Yubari city, *Y. Murata in 1952* (KANA); Mt. Moiwa, *T. Nakai in 1920* (TI); Mt. Apoi, *T. Nakai in 1928* (TI); Ishikari, Nopporo-genshurin, Nishi-nopporo, Ebetsu-shi, *N. Naruhashi 1139* (H, K, MAK, SHIN, TI, TNS, UC); Kitami, Mombetsu-gun, Takino-ue-mura, *S. Okamoto in 1950* (KYO); Kushiro, Mt. Shironuka, *S. Okamoto 584* (KYO); Tokachi, Shibetsu, Shikaoi, *S. Okamoto in 1955* (KYO); Mt. Shiratori, *S. Okamoto 1519* (KYO); Okushibetsu, *S. Okamoto 1811* (KYO); Kamiiso-gun, Kamiiso-cho, Hekirichi-gawa R., *T. Shimizu 0937* (KYO); Hidaka, Saru-gun, Tomikawa, *Y. Takahashi in 1963* (SAP); Sapporo, *Takenobu in 1880* (SAP); Teshio Experimental Forest, Minoshima-goe, *M. Tatewaki in 1928* (SAP); Notapu, *Y. Tokubuchi in 1888* (SAP); Hidaka, Samani, *Y. Tokubuchi in 1892* (SAP); Hidaka, Horoizumi, *Y. Tokubuchi in 1892* (SAP); Ishikari, Uashinai Coal Mine, *Y. Tokubuchi in 1892* (SAP); Hidaka, Saruru-mura, *Y. Tokubuchi in 1892* (SAP); Iburi, Chitose-gun, Aosari, *Y. Tokubuchi in 1893* (SAP, UC); Shiribeshi, Mt. Karibu, *I. Yamamoto in 1923* (SAP); Oshima, Mt. Gusin, *I. Yamamoto in 1925* (SAP); Oshima, Gampiyama, *I. Yamamoto 675* (SAP, TAI); Ishikari, Mt. Tengu, *I. Yamamoto 3752* (SAP); Iburi, Tanibujigawa, Date, *I. Yamamoto 9258* (KYO); Kitami, Sanrubeshibe, Nayoro, *S. Yokoyama in 1892* (SAP); Okawa, Keimagaichi, *S. Yokoyama in 1937* (SAP); Shiribeshi, Okushiri Island, *B. Yoshimura in 1935* (SAP); Konuma-hen, *without collector in 1878* (TI); near Sapporo city, Onuma, *without collector in 1878* (TI); Lake Toyako, *without collector* (MAK 117719). HONSHU: AICHI PREFECTURE: Kitashidara-gun, Nagura, *U.*

*Matsuzaki in 1911* (MAK); Mt. Dando, *G. Murata 6520* (KYO). AKITA PREFECTURE: Kita-akita-gun, Mt. Moriyoshi, *H. Hara in 1959* (TI); Yamamoto-gun, Hibiki-mura, Nibuna, *T. Makino in 1927* (MAK 6944, S); Oja Peninsula, Motoyama, *R. Mochizuki 2236* (KANA); Mt. Moriyoshi-yama, Nakamura to the summit, *H. Ohashi 4852* (TI); Lake Tazawa-ko, *I. Yamazuta 36* (MAK). AOMORI PREFECTURE: Noeiji, mts. of Koiboshi, *U. Faurie 983* (MO, P); Aomori, *U. Faurie 5096* (KYO); Higashi-tsugaru-gun, Tairadate-mura, Yunosawa, *H. Hara in 1959* (TI); Aomori city, Kouhata, *K. Hosoi in 1950* (TNS); Mt. Hakkoda, Jougakura, *K. Hosoi in 1950* (KANA, TNS); Shimokita-gun, Ohata-cho, *K. Hosoi in 1951* (KANA); Mt. Hakkoda, Tsuta, *A. Kimura et al. in 1955* (TUS); Mt. Hakkoda, *H. Koriba s.n.* (TI); Mt. Osoro-san, Shimokita Peninsula, *O. Mori in 1959* (MAK); Shimokita-gun, Saimura, *O. Mori 14312* (S); Mt. Hakkoda, Sukayu to Shinyu to Jogakura, *H. Ohashi 68731* (MAK, TI); Masukawa, Miyama-mura, Minami-tsugaru-gun, *S. Okamoto in 1963* (KYO); Shimokita Peninsula, Osore-yama-yagen, *K. Yoshioka & K. Sugawara in 1964* (TUS). CHIBA PREFECTURE: Mt. Kiyosumi-yama, *S. Asano in 1932* (TNS). FUKUI PREFECTURE: Oono city, from Katugayu to Karikomi-ike, *N. Fukuoka & Y. Inamasu 423* (KYO); Ono-gun, Itoshiro, *G. Masamune 9248* (KANA); Nada-no-sho-mura, *Watanabe in 1965* (KYO). FUKUSHIMA PREFECTURE: Yama-gun, Nishiadzu-cho, S foot of Mt. Iide, *D. E. Boufford & E. W. Wood 19081* (MO); Mt. Futamata, *R. Endo in 1913* (TUS); Nishishirakawa-gun, *N. Imai in 1907* (MAK); Asaka-gun, Tadano-mura, from Yamada-hara to Mitsumori Pass, *H. Hara & S. Kurosawa in 1957* (TI); from Ozenuma to Ozegahara, Shimotashiro, *M. Mizushima 10443* (TI); Minamiaizu-gun, Oze, *G. Nakahara in 1904* (TNS); Minamiaizu-gun, Kotsunagi Pass, *J. Ohwi & M. Tagawa 597* (KYO); Nishishirakawa-gun, Kamaiyama-mura, *D. Shimizu in 1907* (MAK); Nishishirakawa-gun, Kanayama-mura, *D. Suzuki in 1906* (MAK); Mt. Iide, *without collector in 1907* (MAK 117735); Minamiaizu-gun, Numayama Pass, *without collector in 1916* (MAK 117732). GIFU PREFECTURE: Norikura, *U. Faurie 6681* (KYO); Yoshishiro-gun, Miyagawa-mura, *H. Furuike 8325* (KANA); Gunjo-gun, Okuakita-mura, Mizusawa-ue, *H. Kankebo 8092* (KANA); Kijo-gun, Mamba, *N. Satomi in 1961* (KYO); Hakuno village, *K. Shiota in 1923* (KYO); Yoshiki-gun, Miyakawa-mura, from Utsubo to Mannami, *N. Yonezawa 340, 488* (KANA). GUNMA PREFECTURE: Mt. Myogi, Kitakamura-gun, Myogi-machi, Hakuun-zan, *M. Furuse in 1957* (A, KAG, S); Kotsuke, Kouzubokujou, *K. Hiyama 1731* (TNS); Minamimaki-mura, Tsukigata, *N. Ishii 2* (TNS); Tone-gun, Minakami-cho, Mt. Tanigawa-dake, *H. Kanai 4446* (TI); Tone-gun, near Doai, *H. Kanai 4516* (TI); between Tokura & Yamanohana, *S. Kitamura in 1952* (KYO); Tone-gun, Minakami-cho, NE foot of Mt. Tanigawa-dake, *H. Koyama 5525* (KYO, MO); Usui-gun, Hakuunzan in Mt. Myogi-san, *G. Murata 27439* (KYO); Mt. Akagi-san, beside Lake Onuma, *M. Nishida 628* (E, TI); Yubiso, Nishikurosawa, *R. Noguchi in 1933* (TNS); Hanayashiki Spa, *J. Ohwi in 1929* (KYO); Tone-gun, Katashina-mura, from Tokura to Oze, *J. Ohwi & M. Tagawa 238, 244* (KYO); near Karizawa, *T. Saito in 1905* (MAK); Usui-gun, Matsuida-machi, Mt. Miyogi, *K. Satoh in 1954* (TI); Tone-gun, Mt. Omine, *T. Satomi 14460* (S); Azuma-gun, Tsumagoi village, *A. Takizawa 76* (SHIN); Tanigawadake, Yubiso-gawa R., *T. Yamazaki 619* (NCU, TI); Mt. Akani, Lake Akani, *without collector in 1916* (MAK 117730). HIROSHIMA PREFECTURE: Mt. Agatsuma, *W. Sato in 1932* (KANA); Hiba-gun, Otaki-dani, *K. Seto 22603* (OSA). HYOGO PREFECTURE: Yabu-gun, Sekinomiya-cho, NE foot of Mt. Hyonosen, *D. E. Boufford & E. W. Wood 19513* (BM, CM, DS, G, GH, K, KYO, LD, LE, MASS, MHA, MO, NCU, NY, P, PE, S, SHIN, UC); Mt. Hyonosen, *D. E. Boufford et al. 19566* (KYO, MO); Yabu-gun, Oya-cho, Ikada, *D. E. Boufford et al. 19574* (MO); N slope of Mt. Hachibuse, *D. E. Boufford et al. 19591* (BM, CAS, CM, G, GH, K, KYO, LD, MHA, MO, NCU, P, PE, S, SHIN, UC); Mikata-gun, Mt. Sugano-sen, *N. Fukuoka & Y. Inamasu 728* (KANA, KYO); Mt. Ogino-yama, *S. Hosomi 7237* (KYO); Urarokuko, Karatonotani, *E. Ishikawa in 1935* (TAI); Mikata-gun, Onsen-cho, Mt. Oogino-sen, *K. Iwatsuki 6576* (KYO); Mt. Myoken, *S. Kitamura & G. Murata 633* (KYO); Shiso-gun, Haga-cho, SE foot of Mt. Mimuro-yama, Akanishi-dani, *N. Kurosaki in 1976* (KANA); Kiritaki, Onsen-cho, Mikata-gun, *G. Murata 20680* (KYO, MAK); Mikata-gun, Onsen-cho, *G. Murata 20703* (KYO, TI); Mikata-gun, Onsen-cho, from Umigami to Ogino-sen, *G. Murata 20750* (KYO); Sayo-gun, Nanko-cho, Mt. Funakoshi-yama, *G. Murata 33786* (KYO, MO); Shiso-gun, Haga-cho, Tokura, *G. Murata 20363* (KYO); Yabu-gun, Oya-cho, Yokoyuki to Mt. Hyonosen, *G. Murata 22088* (KYO, TI); from Mt. Rokko to Arima, *M. Tagawa 6915* (KYO); Mt. Hino-san, *Y. Yoneda in 1932* (KYO). IBARAKI PREFECTURE: Mt. Tsukuba, *T. Makino s.n.* (MAK 6945); Tsukuba-gun, Mt. Tsukuba, *T. Makino in 1923* (MAK); Mt. Tsunuba, *H. Sakurai in 1911* (E); Mt. Tsukuba, *S. Tako in 1909* (MAK). ISHIKAWA PREFECTURE: Mt. Hakusan, Iwama Spa, *N. Fukuoka in 1961* (KYO); Hakusan, Iwama, *M. Hashimoto 4330* (KANA); Hakusan, *T. Ichimura 1442* (KANA); Hakusan, Ichinose, Shitsudo, *G. Masamune 7345* (KANA); Ishikawa-gun, Hakusan, Tyugu-michi, *G. Masamune 11666* (KANA); Ishikawa-gun, Iwame, *G. Masamune 11926* (KANA, SHIN); Ishikawa-gun, between Ichinose & Murodo, *G. Masamune 16366* (KANA); Kanagawa city, Yokotani-cho, *T. Nishimura in 1959* (KANA); Shiro-yama, *K. Shiota 2723* (GH); Hakusan, Iwama Hot Spring, *H. Sugino in 1956* (KANA); Karagokuman-san, *S. Tanaka in 1961* (KANA); Kanazawa city, Agaharai-yama, *S. Tanaka in 1963* (KANA). IWATE PREFECTURE: Mt. Hayachine, *U. Faurie 13593* (G, MO, P); Mt. Iwate, *M. Honda in 1927* (TI); Shimohei-gun, Oguni-mura, Mt. Hayachine, *H. Kanai in 1959* (TI); Morioka city, Asagishi, *M. Kikuchi in 1967* (TNS);



Kunohe-gun, Hiraniwa-dake, *M. Miora* in 1904 (SAP); Mt. Himekami, *K. Ogata* 4056 (KAG); Mt. Hayachine, *Y. Ogura* in 1915 (TI); Osawa in Miyako city, *H. Ohashi* 9173 (A, FSU, TI); Mt. Iwatesan, *H. Sakurai* in 1900 (TNS); Kamihei-gun, Goyo-zan, *S. Sasamura* in 1954 (MAK). KANAGAWA PREFECTURE: Hakone, *Delessert* in 1883 (G); Mt. Hakone, *M. Hiroe* 5143 (KYO); Kurokura, *K. Hisauti* in 1919 (LD); Mt. Oyama, *Iijima* in 1887 (TNS); Hatano city, Mt. Tanzawa, near Shindainichi, *H. Kanai* in 1952 (TI); Hafano city, Mt. Tanzawa, *H. Kanai* in 1956 (TI); Mt. Tanzawa-yama, *S. Kiyoshi* in 1960 (TNS); Hakone, Ashigarashimo-gun, *T. Makino* in 1919 (MAK 6948, S); Hakone, Mt. Kozuka, *M. Mizushima* in 1949 (TI); Mt. Hakone, shores of Lake Ashino-ko, *S. Okamoto* in 1967 (KYO); Mt. Oyama, *S. Okuyama* in 1958 (TNS); Yabitsu-toge, *T. Saito* in 1963 (TNS); Hakone, Ashino-ko, *T. Sawada* 2286 (E), 2287 (TI); Hakone, Kojiri, *T. Sawada* 2289 (DAO, TI); Hakone Skyline, *J. Sugimoto* in 1967 (TNS); Hakone, middle elevation of Mt. Kami-yama, *H. Yamamoto* 2011 (TNS); Hakone, Otome Pass, *H. Yamamoto* 2446 (TNS); Mt. Tanzawa, *T. Yamazaki* 783 (K, TI). KYOTO PREFECTURE: Yosa-gun, Iwaka-mura, Mt. Taiko, *Y. Araki* in 1932 (KYO); Kita-kuatagun, *Y. Araki* 367 (KYO); Kita-kuatagun, Chi-mura, Experimental Forest of Kyoto Univ., *Y. Araki* 476 (KYO); Mt. Hiei, *S. Hattori* in 1926 (TI); Kyoto city, Sakyo-ku, Mt. Kurama, *M. Hiroe* 18074 (UC); Ashiu, Chii-mura, *T. Horikawa & G. Nakai* 5590 (KYO, SAP); Mt. Hiei, *S. Kawagoe* 2092 (KAG); Mt. Hiei-zan, between Shimeigadake & Seiryuji, *G. Murata* 11417, 13030 (KYO); N of Kyoto, Daihizan, *G. Murata* 9906 (KYO); Ashiu, Chii-mura, *G. Nakai* 5590 (MICH); Ashiu Experimental Forest of Kyoto Univ., *A. Nitta* 12586 (KYO), *S. Okamoto* in 1936 (KYO); Mt. Hiei, *M. Tagawa* 285 (KYO); Kurameyama, *without collector* in 1900 (MAK). MIE PREFECTURE: Mie-gun, Komonomachi, Mt. Kamaga-dake, Nagaishi-dani, *N. Fukuoka* 4938 (KYO); Kameyama city, summit of Mt. Nonobori, *N. Fukuoka* 5143 (KYO, SHIN); Ichishi-gun, Misugi-mura, Mt. Miune, Hirakura Experimental Forest, *N. Fukuoka* 6052 (KYO); Mt. Hirakura, *S. Kitamura* in 1963 (KYO); Ichishi-gun, Misugi-mura, Experimental Forest of Mie Univ., *G. Murata* 18489 (KYO); Osugi-dani, *S. Okamoto* in 1941 (TNS); Suzuka-gun, Mt. Nonobori, *T. Shimizu* 4020 (KYO). MIYAGI PREFECTURE: Mt. Fubosan, Namari-zawa, *D. E. Boufford & E. W. Wood* 19873 (CM, KYO, MHA, MO, PE); Ebino to Eodani, *Honda* in 1929 (KAG); Okunikkawa, *T. Ishida & Y. Hayashi* in 1959 (KYO); Sendai, Aobayama, Tohoku Univ. Bot. Gard., *A. Kimura & K. Ohmiya* in 1960 (TUS); Miyagi-cho, Okunikkawa, *C. Kimura* in 1970 (TUS); Kinkasan Island, *C. Kimura* in 1970 (TUS); between Sone & Gaga, *A. Kimura & S. Sugaya* in 1950 (TUS); Mt. Zao, *A. Kimura & S. Sugaya* in 1953 (TUS); Natori-gun, Okunikkawa, *H. Ohashi* 9993 (TI); Gaga Hot Spring, *S. Okayama* 9319 (TNS); Kinka-san Island, *S. Sugaya & T. Fujita* in 1955 (TUS); Mt. Kurikoma, *S. Sugaya et al.* in 1952 (TUS); Mt. Kinka-zan, *Z. Tashiro* in 1935 (KYO). NAGANO PREFECTURE: base of Mt. Norikura, *U. Faurie* 6681 (BM, G, KYO, P, W); Karuizawa, Sentinel Rock, *H. E. Fox* in 1912 (BM); Nakabusa-onsen, *H. Fujimori* 172 (SHIN); Shimoina-gun, Ikuta-mura, *M. Fukuyo* 75 (TNS); Shimoina-gun, Ikuta-mura, Kayarama, *M. Fukuyo* 131 (TNS); Shimoina-gun, Oshika-mura, *H. Furuike* in 1956 (KANA); Shimoina-gun, Tatsuoka-mura, *I. Furusawa* in 1940 (TI); Shimoina-gun, Oshika-mura, from Fukasawa to Tsubame-iwa, *I. Furusawa* in 1940 (TI); Minami-azumi-gun, Mt. Jyonen-dake, *I. Furusawa* in 1941 (TI); Karuizawa, *F. C. Greatrex* K52/30 (TI); Shimashima, *S. Hattori* in 1925 (TI); Togakushi-mura, *H. Ichio* in 1966 (KANA); Kamiminochi-gun, Kinasa-mura, Okususubana, *S. Ito* 192 (SHIN); Mt. Nomugi-toge, *T. Ito* in 1891 (TNS); Shimoina-gun, Ooshika-mura, from Kamazawa to Koshibuyu, *K. Iwatsuki & H. Koyama* 33 (KYO, TNS); Shimoina-gun, Ooshika-mura, from Koshibuyu to Hirogawara, *K. Iwatsuki & H. Koyama* 69 (KYO, TNS); Nishi-chikuma-gun, Todachi-mura, Todachi-taki, *H. Kanai* in 1957 (TI); Suwa city, between Kirigamine & Yashima, *S. Kobayashi* in 1960 (CAS, MAK); Kiso, Mt. Ontake, *G. Koidzumi* in 1910 (TI); Oshika-mura, Kamasawa, *S. Kuraishi* in 1953 (TI); Taira-mura, Ohmachi city, Otsumetasawa, *S. Mimoro & S. Tsugaru* 987 (KYO); foot of Mt. Asama, from Kose to Shiraito-no-taki, *M. Mizushima* in 1951 (TI); Tobira-toge, *S. Momose* in 1933 (TI); Shimoina-gun, Igara-mura, Yomogidaira, *M. Muramatsu* 648 (TNS); Kamiina-gun, Ooshika-mura, Mt. Odaka-yama, *M. Muramatsu* 1512 (TNS); Shimoina-gun, Kizawa-mura, Nishisawado, *M. Muramatsu* 2642 (TNS); Shimoina-gun, Kizawa-mura, Iroudo, *M. Muramatsu* 3473 (TNS); Togakushi-mura, *G. Murata* 6413 (KYO); Nishichikuma-gun, Nagiso-cho, Shizumo Government Forest, *G. Murata et al.* 142 (KYO); Yatsuga-dake, *T. Naito* 6770/14330 (KAG); Mt. Togakushi, *Y. Nakajima* in 1913 (TUS); Sasagamine, from Bokujo to Mt. Kuromime, *A. Nitta* 11714 (KYO); Tokugo Pass, *Y. Ogura* in 1917 (TI); Mt. Komaga-dake, *T. Saiki* in 1910 (MAK); Mt. Togakushi, *H. Sakurai* in 1898 (TNS); Mt. Arafune, *K. Sato* 178 (TI); Nakagomi-cho, Uchiyama, Mt. Arafune, *K. Sato* 324 (TI); Chiisata-gun, Sugadaira, along Daimyo-jinzawa, *T. Shimizu* 18996 (SHIN); Yokokawa-dani valley, Okaya, *T. Shimizu* 25803 (SHIN); Suwa-gun, Fujimi-cho, Shirakawa valley, *T. Shimizu* 25870 (SHIN); Nishichikuma-gun, Shinkai-mura, Experimental Forest of Kisosanrin High School, *Y. Shirai* 57 (SHIN); Kitasaku-gun, Karuizawa, Usui-toge, *Y. Tateishi* 1333 (TI); Shimoina-gun, Oshika-mura, Shiokawa, *K. Teramoto* in 1947 (TI); Shimoina-gun, Kisawa-mura, Toyama-gawa R., *Yamasaki et al.* in 1954 (TI); Mt. Ontake, *R. Yatabe* in 1880 (BM); Kita-azumi-gun, Mt. Hakuba, *T. Yazawa* in 1903 (SAP); Takeishi Pass, *without collector* in 1931 (TI). NARA PREFECTURE: Mt. Omine, *K. Adachi* in 1910 (MAK); Yoshino-gun, Tenkawa-mura, from Dorogawa to Houriki-toge, *N. Fukuoka & M. Hotta* 6

(KANA, KYO); Yoshino-gun, Tenkawa-mura, Mt. Imine, between Chosen-dake & Tsubonouchi, *N. Fukuoka & M. Hotta* 271 (KYO); Yoshino-gun, Mt. Shakaga-take, *M. Hiroe* 18226 (KYO, UC); Mt. Omine, *S. Kitamura in 1950* (KYO); Mt. Wasanata-yama, *T. Kodama* 10824 (OSA); Mt. Kasasute-yama, *G. Koidzumi in 1922* (KYO); Mt. Odaigahara, *G. Koidzumi in 1922* (KYO); Odaigahara-yama, Goshiki-yu, *G. Nakai* 3476 (KYO); Yoshino-gun, Mt. Odaigahara, *H. Nishimura* 485 (KAG, KYO, TNS); Omine Mts., Yoshino-gun, from Mt. Misen to Gyogaeri, *T. Shimizu* 4304 (KYO). NIIGATA PREFECTURE: Mt. Kurohime, *T. Ajima* 4312 (KANA); Kitauonuma-gun, Okutadami Lake, Nakanomata, *H. Kanai et al.* 8910 (TI); Nakauonuma-gun, Yuzawa, *S. Kobayashi* 15142 (S); Mt. Mioko, *S. Matsuda in 1894* (KYO); Kitauonuma-gun, Irihiro-mura, Mt. Asakusa, *T. Yamazaki* 6534 (TI); Itoigawa city, Mt. Nyogo, *T. Yasushima in 1976* (KANA); Mt. Shimizu-toge, without collector in 1886 (K); Kitauonum-gun, Gin-zan-daira, without collector in 1908 (MAK); Tazawa-mura, without collector in 1931 (TI). OKAYAMA PREFECTURE: Hideta-gun, Mimasaka, *S. Arimoto in 1903* (SAP); Ushiroyama, *S. Arimoto in 1903* (GH); Okayama, *T. Makino in 1906* (MAK). OSAKA PREFECTURE: Minamikawachi-gun, Mt. Kongo, *T. Makino in 1927* (DAO, KAG, KYO, MAK 6949, TI); Minamikochi-gun, Chihaya-akasaka village, Mt. Kongo, *S. Mimuro et al.* 10439 (KYO); Mt. Kongo-san, from Chihaya to Fushimi-toge, *G. Murata* 27049 (KYO, US); Mt. Kongo-san, *M. Tagawa* 3354 (KYO). SAITAMA PREFECTURE: Chichibu-gun, Ryoogami-mura, Mt. Futago, *H. Hara & S. Kurosawa in 1957* (TI); Tanzawa, Genmo-kura, *K. Hisauchi* 1641 (TI); Chichibu, *T. Naito s.n.* (KAG); Musashi, Mt. Izugatake, *S. Okuyama in 1935* (TNS); Chichibu-gun, Mt. Mitsumine, *F. Sakaguchi in 1906* (MAK); Chichibu, Kawaishi-mura, *H. Sakurai in 1892* (TNS); Mt. Buko, *S. Tanaka in 1963* (KANA). SHIGA PREFECTURE: Gamou-gun, Ichihara-mura, Chikusa-goe, *C. Hashimoto* 1506 (TNS); Inukami-gun, Oikedani, N of Oike-dake, *H. Koyama & N. Fukuoka* 28 (SHIN); Mt. Ibuki, *T. Makino in 1906* (MAK); Mudoji-dani, Mt. Hiei-zan, *G. Murata* 20265 (KYO); Gamo-gun, Nishioji village, *G. Nakai* 4693 (KYO); Ohmi, Mt. Hiei-zan, without collector in 1908 (TNS 16172). SHIMANE PREFECTURE: Sahime-mura, Mt. Sanbei-yama, *G. Murata* 11708 (KYO); Mt. Senzu, *T. Naito in 1927* (KAG). SHIZUOKA PREFECTURE: Akaishi Mts., Koshibu-gawa, *Furusawa & Kuraishi in 1953* (TI); Mt. Hakozan, *G. Hashimoto in 1933* (TNS); Miyake Island, *Hayashi in 1936* (KYO); Mt. Fuji, Kamitake-yama, *B. Hayata in 1924* (TI); Skyline Hiking Course between Nakko Pass & Amagi Pass, *M. Hotta* 6117 (KYO); Aitaka Mts., from Suyama to Kurotake, *H. Kanai* 5826 (TI); Aitaka Mts., from Yanagisawa to Aitakasan, *H. Kanai* 5828 (TI); Aitaka Mts., Echizen-dake, near Fujimi-dai, *H. Kanai* 5832 (TI); Aitaka Mts., Nokogiri-dake, *H. Kanai* 5833 (TI); Aitaka Mts., Motosawa, *H. Kanai* 7233, 7345 (TI); Umegashima, *S. Kitamura in 1966* (KYO); Nakamata, *S. Mashiko in 1954* (KAG); Mt. Amagi, *S. Matsuda in 1899* (KYO); Ohwigawa-joryu, Tokusa, *S. Matsuda in 1954* (TI); Kitamuro-gun, between Chihiro Pass & Funatsu, *G. Murata* 10192, 10201 (KYO); Abe-gun, Umegashima-mura, Ootaki, *G. Murata et al.* 214 (KYO, SHIN); Mt. Amagi, *T. Nakai in 1931* (TI); Mt. Kintoki to Mt. Ashigara, *H. Noguchi* 4850 (KAG); Mt. Amagi, *H. Noguchi* 6381 (KAG); Seto-no-tani, Utoge-no-taki, *D. Shimizu in 1930* (TI); Mt. Fuji, Subashiri, *M. Takeuchi in 1948* (TI); Mt. Fuji, Suruga, without collector in 1879 (TNS 8715). TOCHIGI PREFECTURE: Nikko, Umagayeshi, *J. Bisset* 4206 (BM, E); foot of Mt. Nantai-san, *S. J. Enander in 1913* (S); Nikko, *M. Furuse in 1954* (A); Nikko, from Chuzenji to Shobugatake, *M. Honda in 1924* (TI); Nikko, *T. Ichimura* 1438 (KANA); Kirifuri, *H. Ito in 1931* (TI); Nikko city, Nikko, *T. Makino in 1903* (MAK, S, TUR); Nikko, Urami-taki, *M. Mizushima in 1946* (KANA); Nikko, near Jakko-no-taki, *J. Murata & H. Ohashi in 1975* (KYO, TI); Nasu, from Santogoya-onsen to Ootoge, *G. Murata* 18217 (KYO); Katashina-mura, from Oshimizu to Mihira Pass, *M. Nishida in 1950* (TI); Ose, *J. Ohwi & M. Tagawa* 238 (UPS); Shioya-gun, Kuriyama-mura, *S. Sugaya in 1934* (TUS); near Oonuma, Oku-shiobara, *S. Suzuki in 1951* (UC, WTU); Kamitsuga-gun, Furumine Shrine, *D. Suzuki in 1906* (MAK); middle elevation of Mt. Koshin-zan, *M. Tagawa & K. Iwatsuki in 1957* (KYO); Nikko, *H. Takeda* 254 (K), *T. Uno* 254 (BM); Mt. Tanigawa-dake, Tanigawa-mototani, *T. Yamazaki in 1948* (TI). TOKYO PREFECTURE: Mt. Takao, *S. Hattori in 1922* (TI); Motohachioji, *K. Hisauti s.n.* (LD); Mt. Takao, *K. Hisauti* 1640 (LD, TI); Mt. Ryogami, *K. Hisauti in 1942* (MT); Mt. Takao, *K. Hiyama in 1929* (TNS); Nishitama-gun, Asakawa, Mt. Takao, *H. Kanai in 1954* (TI); Asakawa, Koshita-sawa, *H. Kanai* 298 (TI); Nishitama-gun, Nippara, Kurasawa, *H. Kanai* 4234 (TI); Nishitama-gun, Mt. Mitake-manayo Falls, *S. Kobayashi* 1049 (CAS); Mt. Omae, *H. Mizushima in 1946* (TI); Nishitama-gun, Mt. Minoto, *M. Mizushima* 10034 (UC); Shiro-yama, *S. Okuyama in 1934* (TNS); Kamagoke-gawa, *H. Ono in 1948* (TI); Shiro-yama, *T. Sato in 1934* (TNS); Omue city, Kaminari-gi, *T. Satow* 8733a (KYO); Akikawa, *T. Satow* 8895 (KYO); Mt. Takao, *S. Suzuki in 1951* (UC, WTU); Okuchichibu, Deosing-san, *M. Tagawa in 1930* (KYO); Nishitama-gun, Mt. Mitake, *M. Tsunaki* 3251 (TI); Kawanori-yama, *T. Yamazaki & H. Ono in 1948* (TI); Nishitama-gun, Mt. Takamizu-san, *T. Yamazaki* 2602 (TI); Nishitama-gun, Gozen-yama, *T. Yamazaki* 2282 (TI); Tokyo-teishitsu, without further data (TNS 13227). TOTTORI PREFECTURE: Daisen, from Masumizuhara to Miyama, *M. Hashimoto* 3815 (KANA); Saihaku-gun, Kabuto R., *A. Tanaka* 15871 (KYO); Yazu-gun, Wakazakura town, Mt. Hino-san, *A. Tanaka* 12878 (KYO). TOYAMA PREFECTURE: Tateyama-machi, Midaga-hara, *L. Charette* 1970 (MO); Tateyama, *T. Ichimura* 1437 (KANA); Shimoshinkawa-gun, Asahi-machi, near Ogawa Hot Spring, *H. Kanai in 1958* (TI), *H. Kankeko in 1962*

(KANA); Nei-gun, Yamada-mura, Mt. Ushigatake, A. Kirino 788 (COLO, S, TNS); Shinkawa-gun, Kamiichi-machi, Kamaike, N. Kurosaki 2140 (KYO), 2141 (KANA, TNS); along Katagai-gawa, Uozushi, K. Nagai in 1969 (KYO); Kurobe, Kanetsuri-onsen, J. Ohwi 7305 (KYO), S. Okamoto in 1935 (KYO); Mt. Ioo, Nakane-Yokotani Pass, S. Ooura in 1961 (KYO); Wada R., without collector in 1907 (MAK 6936). WAKAYAMA PREFECTURE: Minamikawachi-gun, Mt. Kongo, T. Makino in 1927 (S); Nishimuro-gun, Ooto-mura, Wada R., G. Murata & F. Konta 72 (KYO), 175 (KYO, MAK, TI); Hidaka-gun, Naotsuma-mura, Kawamata, T. Nakashima in 1929 (KYO, TI); Hidaka-gun, Kawakami-mura, Seo, T. Nakashima in 1931 (TI); Hidaka-gun, Ryujin-mura, Nanogakiuchi, T. Nakashima in 1931 (TI); Mt. Koya, Y. Ogawa in 1956 (KANA); Kumano-gawa-cho, Oguchi, Y. Ogawa in 1959 (KANA); Arita-gun, Yawata-mura, S. Okamoto 19428 (TI); Experimental Forest, K. Sato 22882 (SAP); Gonzui-Kubotani, Wakayama Experimental Forest, M. Tatewaki in 1930 (SAP); Higashimuro-gun, Mitsukoshi-toge, without collector in 1883 (TI); Mt. Koyasa, without collector in 1912 (MAK). YAMAGATA PREFECTURE: W. R. Carles in 1895 (E); Mt. Asahi, Nekogawa, Higaregoya, H. Hara in 1959 (TI); Mt. Asahi-dake, Kodera-kosen, H. Hara in 1959 (TI); Nishimurayama-gun, Asahi-cho, from Kikawa to Asahi Kosen, K. Iwatsuki et al. 578 (KAG, KYO, SHIN, TNS); Oguni, C. Kimura & T. Moruma in 1966 (TUS); Higashitagawa-gun, Uenagawa-mura, K. Mori in 1931 (KANA); Ootori-mura, T. Nagasawa in 1891 (TNS); between Yamdera & Futakuchi Pass, H. Ohashi in 1960 (TUS); Kabuto-iwa, in Okuyamadera, H. Ohashi 2548 (TI); Yamagata city, near Kabutoiwa, H. Ohba 718033 (H); from Chojabara to Otamagawa, M. Ono in 1954 (TI); Mt. Iide near Haraikawa, T. Yamazaki in 1943 (TI); foot of Mt. Azuma-san, Yoshida in 1915 (MAK). YAMAGUCHI PREFECTURE: Suwo, Kuko-gun, Mt. Jakuchi, J. Nikai in 1920 (TNS); Mt. Kanchi, Z. Tashiro s.n. (KYO). YAMANASHI PREFECTURE: Ensan city, from Daibusatsurei to Sakeishi, N. Fukuoka 5053 (KANA); Unoshima, K. Hiyama 6910 (TNS); foot of Mt. Koma, S. Kitamura in 1931 (KYO); Minamitsuru-gun, Mt. Fuji, Komitake, S. Kobayashi 1468 (CAS); Minamikuma-gun, Tentsuki Pass, Matsuda & Fujita in 1954 (TI); Mt. Fuji, Kurotsuka, H. Muramatsu in 1927 (TI); Kozuke-hara town, Gun-nai, S. Okamoto in 1935 (KYO); Kiosato, foot of Mt. Yatsuna-dake, M. Ono in 1964 (MAK); Ashi-hara-mura, Mt. Kitadake, vicinity of Hirogawara, H. Tamura & M. Hotta 3742 (KYO); Dai-bosatsu-mine, H. Uematsu in 1949 (TI); Nakakoma-gun, Ashiyasu-mura, T. Yamazaki in 1954 (TI). KYUSHU: FUKUOKA PREFECTURE: Tagawa-gun, Soeda-cho, Mt. Hiko, T. Hashimoto in 1952 (TI); Mt. Shaka-dake, S. Masamura 14 (KAG). KAGOSHIMA PREFECTURE: Kirishima, H. Asuyama in 1929 (TNS); Mt. Kirishima, Takachihogawara, S. Hatusima 26175 (KAG); Mt. Higashi-kirishima, Z. Tashiro in 1919 (KYO). KUMAMOTO PREFECTURE: Mt. Ichifu-san, S. Hatusima 14161 (KAG); Gokanosho, Mominoki, S. Hatusima 15023 (KAG); Mt. Karimata-yama, Nihonsugi, Gokanosho, S. Hatusima 27799 (KAG); Matashidani, Gokanosho, S. Hatusima 31943 (KAG); Shakain, M. Kozuma in 1933 (TNS); Momiki, Gokanosho, S. Sako 997 (KAG); Mt. Kamifukune, Gokanosho, S. Sako 1197 (KAG); Yatsushiro-gun, Nasugoe, Z. Tashiro in 1915 (TNS). MIYAZAKI PREFECTURE: Nishiusuki-gun, Hinokage-cho, from Kamikawa to Mt. Doo-dake, N. Fujita 156 (KANA, KYO); Mt. Kirishima, Ebino, S. Hatusima 15126 (KAG); Hori & Mt. Okue, S. Hatusima & S. Sako 25179 (KAG, KYO); Mt. Wanizuka, S. Hatusima 32654 (KAG); Koyu-gun, Kijiro-mura, Mt. Osuzu, I. Hurusawa in 1949 (TI); Higashi-usuki-gun, Togo-mura, from Tabuki to Mt. Osuzu, H. Kanai in 1958 (TI); Higashiusuki-gun, Shiiba-mura, near Nakayama, H. Kanai in 1958 (TI); Mt. Kirishima, H. Otagawawachi s.n. (KAG); Kitamorogata-gun, Ushitoge, S. Tanaka in 1890 (TNS); Osuzuyama, Tuno-machi, S. Yosie in 1936 (TI). NAGASAKI PREFECTURE: Mt. Onsen-dake, Kozuma & Masayuki 31234 (TNS); Nagasaki, C. Maximowicz in 1863 (GH). OITA PREFECTURE: Mt. Kuju, S. Hatusima in 1952 (KAG), S. Sako 2789 (KAG); Kuju Range, Mt. Waita-zan, M. Sato 2810 (KAG); Yabakei, M. Togashi in 1961 (TI); Yufuin, M. Togashi 7295 (TI). SHIKOKU: EHIME PREFECTURE: Iyo, Tsuchigoya, H. Asuyama in 1931 (TNS); Niihama city, Sasagamine, T. Ishikawa 42 (KYO); Uajima city, Mt. Oniga-jo, M. Kono in 1907 (MAK); Kami-ukena-gun, Odamiyama, Y. Momiyama 0-39 (TI); Mt. Ishizuchi, T. Takatsu in 1971 (KANA); Uajima city, Nametoko, Uemura in 1896 (MAK); Mt. Tamatatsuri, M. Yamanaka in 1953 (TUS); Mt. Ishizuchi, without collector in 1905 (MAK). KOCHI PREFECTURE: Aki-gun, Umaji, I. Doi in 1901 (MAK); Mt. Yanase-yama, S. Hatusima 22027 (KAG, MAK); Nagaoka-gun, Mt. Kuishiyama, G. Murata 10805 (KYO); Takaoka-gun, Honokawa, S. Okamura in 1904 (MAK); Bokunokawa, Chio valley, S. Okamura 35 (MAK); Aki-gun, Nishikawa, N. Satomi in 1954 (KANA); Aki-gun, Yanase, Nishikawa, N. Satomi in 1956 (KAG, MAK, S); Nagaoka-gun, Mt. Kajigamori, K. Seto 2804 (OSA); Mt. Yokogura, Z. Tashiro in 1901 (KYO); Yanase, Y. Ueda in 1905 (MAK); Nanokawa, K. Watanabe? in 1892 (K, US); Mt. Tebako, S. Yano in 1890 (TI). TOKUSHIMA PREFECTURE: Mt. Taketsu, T. Kasai in 1912 (MAK); Miyoshi-gun, Higashi-yayama-mura, Ochiai, G. Murata 7778 (KYO); Naka-gun, Shio-tani-mura, G. Nakai 4132 (KYO); Mt. Tsurugi, J. Nikai 1976 (TNS), S. Nishima 1976 (TI), H. Toyoshima in 1954 (TNS).

KOREA, SOUTH. Cheju-do ("Quelpaert Island"), I. C. Chung 3900 (MICH); Zenranan-do, Mt. Hakuun-san, S. Hohzawa in 1934 (TNS); Zenranan-do, Mt. Chii-san, S. Hohzawa in 1937 (TNS);

Mt. Chii ("Mt. Tii"), S. Okamoto 17933 (KYO); Cheju-do ("Quelpaert Island"), E. Taquet 827 (G, LE), without collector 1487 (KYO), without collector 5177 (MICH).

Along with *Circaea cordata*, *C. erubescens* is one of the two most distinctive species of *Circaea*. The shallowly notched, obtrullate petals are unique in the genus. The presence of an exerted nectar-secreting disc; relatively long pedicels in flower and fruit; obovoid non-sulcate fruits; slender, purple sepals; conspicuously reddish-purple, somewhat shining nodes in life; and distinctive petals make *C. erubescens* easily recognizable. Except for the uncinata hairs on the ovaries, *C. erubescens* is usually glabrous throughout but some populations from Japan and from Cheju-do (Quelpaert Island), South Korea, may have the stem more or less densely pubescent with very short, almost dust-like, falcately recurved hairs. Most plants of *C. erubescens* have a somewhat spindly appearance and the usually numerous racemes, instead of being straight and erect as in other species, often diverge in various directions in relation to each other or may even project at right angles to the central axis of the plant. Often, in contrast to other species where the racemes are more or less equal in length on a single plant, the raceme branches in *C. erubescens* may be very unequal in length on the same plant.

Plants of *Circaea erubescens* from the western part of the range tend to have the leaves more consistently broadly ovate and less often lanceolate than plants from the central and eastern parts of the range. These western plants resemble *C. glabrescens* vegetatively and have been confused with that species in the past. *Circaea glabrescens* always has the nectary wholly included within the floral tube, petals wider than long, and the apical notch 0.3 mm or more long, generally pubescent buds, and generally shorter pedicels in both flower and fruit. *Circaea glabrescens* also has the stem pubescent while *C. erubescens* has glabrous stems in the regions where the two species overlap.

*Circaea erubescens* exhibits a greater range of ecological tolerance than other species of the genus. It is found in rocky or stony soils at the margins of streams, in moist alluvial forests, in fine soils, and on steep, often well drained slopes in upland areas in diverse soil types. This wide ecological amplitude allows *C. erubescens* to come in direct contact with a large number of other species and no doubt accounts for the greater number of known hybrids involving *C. erubescens* than any other species. *Circaea erubescens* is known to hybridize with *C. alpina* subsp. *alpina*, *C. cordata*, *C. lutetiana* subsp. *quadrisulcata*, and *C. mollis*. Additional hybrids between *C. erubescens* and *C. alpina* subsp. *caulescens* should be sought in Japan and in eastern China where the two come in contact, between *C. erubescens* and *C. alpina* subsp. *imaicola* in Taiwan and in southwestern China, between *C. erubescens* and *C. repens* in southwestern China, although it is not certain at the present time whether these latter two species come into direct contact, and between *C. erubescens* and *C. glabrescens* in central China. The ranges of *C. erubescens* and *C. repens* overlap only in a small area in southwestern China and the two species may be isolated altitudinally. Still, this should not preclude the possibility that hybrids may have been formed in the past. Raven (1963) has suggested that the widespread occurrence of *C. × intermedia* (*C. alpina* subsp. *alpina* × *C. lutetiana* subsp. *lutetiana*) outside of the range of one or both of the parents in the British Isles may be due to the

vegetative persistence of the hybrids from past times when climates were favorable for the two parents to grow together and hybridize.

**6. *Circaea repens* Wallich ex Asch. & Magnus, Bot. Zeitung (Berlin) 28: 761. 1870.—FIG. 16.**

*Circaea repens* Wallich, Numer. list, no. 6341. Nom. nud.

*Circaea lutetiana* sensu C. B. Clarke, in J. D. Hooker, Fl. Brit. India 2: 589. 1879; non Linnaeus, 1753.

*Circaea alpina* L. var. *himalaica* C. B. Clarke, in J. D. Hooker, Fl. Brit. India 2: 589. 1879. TYPE: Nepal, Gosainthan, 1824, *N. Wallich 6342* (K, lectotype; E, 2 sheets; G, 2 sheets; K, 2 sheets, isolectotypes; BM, LIV, probable isolectotypes).

Erect or occasionally decumbent at the base, 1.5–10 dm tall, simple or very rarely branched below the inflorescence; forming filiform rhizomes, each producing late in the season a tuberous thickening at the apex, the tubers giving rise to the following year's plants from their apices and to the following year's rhizomes from their nodes. Plants pubescent; the stem with soft, short, falcately recurved hairs, 0.2–0.3 mm long; the axis of the inflorescence and pedicels with capitate and clavate-tipped glandular hairs, 0.2–0.3 mm long, these merging with and giving way to the recurved hairs of the stem at the base of the inflorescence; the petioles with upwardly curved, falcate hairs, 0.2–0.3 mm long, these continuing along the main veins of the leaf on both surfaces, both surfaces of the leaf also with straight or slightly curved hairs, 0.3–0.5 mm long, these more numerous along the veins. Stem green, rarely reddish, the nodes brown, axis of the inflorescence green or somewhat purple. Leaves horizontally spreading, deep green or green, opaque, those just above the middle of the stem the largest, (1.8–)3–7(–9) cm long, (1.5–)2.5–5 cm wide, becoming gradually reduced in size upward and eventually bractlike and opposite, or the uppermost alternate, in the lower part of the inflorescence, gradually to abruptly reduced in size downward; narrowly to broadly ovate, rarely nearly orbicular, acute to short acuminate at the apex, broadly cuneate to cordate but more commonly rounded at the base, minutely to prominently denticulate. Petioles 1–5.5 cm long, with or without greatly reduced branches arising in the axils. Inflorescence pubescent, often densely so, with short, glandular hairs 0.2–0.3 mm long, and occasionally with a few, sharp pointed, patent hairs, 0.3–0.5 mm long, intermixed; a simple terminal raceme or, more commonly, the terminal raceme branched at the base and with secondary, simple racemes at the tips of the uppermost, reduced branches, when branched, the lateral branches alternate, rarely opposite, subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, 1.5–2 cm long at initiation of flowering, to 20 cm long at cessation of flowering; the lateral racemes ca. 2 cm long at initiation of flowering, to 18 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels (1.3\*–2.3–)3–5 mm long, slightly ascending or, more commonly perpendicular to the axis of the raceme, pubescent, with capitate and clavate-tipped, glandular hairs, 0.1–0.3 mm long, with or without a minute bracteole, to ca. 0.5 mm long, at the base. Fruiting pedicels 4–8(–12) mm long. Buds sparsely pubescent, rarely glabrous, with short, glandular hairs ca. 0.2 mm long; white, green or reddish-tinged, elliptic, oblong to obovate to narrowly obovate in outline, short

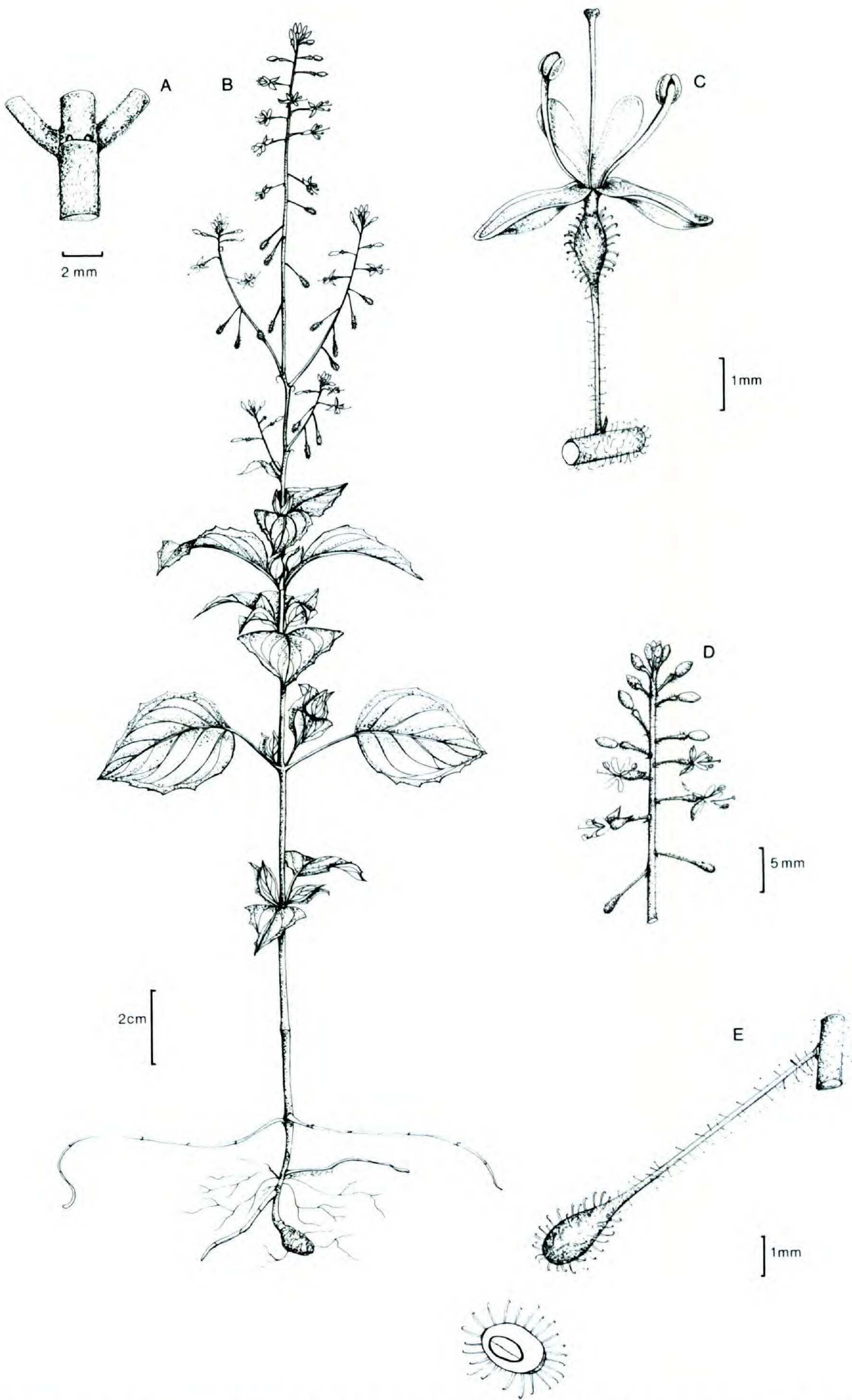


FIGURE 16. *Circaea repens* Wall. ex Asch. & Magnus.—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note absence of exerted nectary.—D. Inflorescence.—E. Fruit. From *Stainton 1380* (E).

acuminate to rounded at the apex, from the summit of the ovary, (1.9–)2.3–3.2 mm long, 0.7–1.5 mm thick just prior to anthesis. Ovary 1.3–1.5 mm long, 0.6–0.8 mm thick at anthesis, ellipsoid to obovoid, densely covered with soft, translucent, uncinuate hairs. Floral tube (0.2\*–)0.4–0.8 mm long, 0.2–0.3 mm thick at the narrowest point, funnelform. Sepals (1.1\*–)1.8–2.5 mm long, (0.7\*–)1.1–1.5 mm wide, pubescent on the abaxial surface, rarely glabrous, with hairs as on the buds; white, green or reddish-tinged; oblong to ovate, gradually rounded from above the middle to the obtuse or acute apex, spreading to reflexed in flower. Petals (1\*–)1.4–2.3 mm long, (1\*–)1.3–2(–2.9) mm wide, about as long as wide, white or pink, broadly to narrowly obtriangular in outline, V-shaped; the apical notch (0.5\*–)0.7–1.4 mm deep, commonly  $\frac{3}{4}$  the length of the petal. Stamens erect and parallel with the style or spreading at anthesis, subequal to or shorter than the style; filaments (1.8\*–)1.9–3.4(–3.9) mm long; anthers 0.3–0.5 mm long, 0.3–0.4 mm thick. Style straight, erect, (2.2\*–)2.6–4.2 mm long, topped by a shallowly bilobed, obtriangular stigma, ca. 0.4 mm tall, ca. 0.5 mm thick. Nectar secreting disc inconspicuous, wholly within the floral tube. Mature fruit (2.5\*–)3.5–4.2 mm long, 0.9–1.6 mm thick, narrowly to broadly clavate, rounded at the apex, tapering smoothly to the pedicel, unilocular and 1-seeded, without prominent ribs and deep sulci, the surface smooth except for a shallow groove representing an extension of the pedicel on the dorsal surface; densely covered with stiff, translucent, uncinuate hairs, 0.4–0.7 mm long, and with fewer, glandular hairs ca. 0.1 mm long. Fruiting pedicels spreading at right angles to the raceme axis to slightly reflexed. Combined length of pedicel and mature fruit, (6.8\*–)7.5–15 mm long. Gametic chromosome number,  $n = 11$ . \* Measurements of plants from Bhutan and Sikkim.

TYPE: Nepal, vicinity of Kathmandu, 1821, *N. Wallich 6341* (K, lectotype; BM, G, 2 sheets, K, W, isolectotypes).

Distribution (Fig. 17): Shade of moist to wet forests and brushy thickets or in moist open places. China, in western Hubei, south-central and southwestern Sichuan and Yunnan; Burma (1 collection); Bhutan, Nepal, and northeast India west nearly to Kashmir; Pakistan (one collection). Between (1,500) 2,300 and 3,300 m. Flowering early July to October and sporadically into early November.

#### Specimens examined:

BHUTAN. Punakha-Suchala, *S. Bowes Lyon 5049* (BM); Chukka Duupu, *R. E. Cooper 1256* (E); Chukka, *R. E. Cooper 1274* (BM, E); Dotena Limpu, *R. E. Cooper 3302* (BM, E); Nam Tamai valley (Adung Wang), *F. Kingdon-Ward 13510* (BM); Julu & Denchung Khoma Chu, *F. Ludlow et al. 21392* (BM, DS); near Ritang, *S. Nakao 835* (KYO).

CHINA. HUBEI: Shennongjia, *Shennongjia Exped. 10851, 31695* (PE). SICHUAN: environs of Ta-Tsien-lou, *M. Bonvalot & Prince Henri D'Orleans s.n.* (P); Emei Hsien, Emei Shan, *C. Y. Chiao & C. S. Fan 473* (A); Baoxing (P'ao-hsing) Hsien, *K. L. Chu 3242* (BM, E, NAS, W), *3381* (BM, E, PE, W), *3403* (PE), *3476* (BM, E, PE), *3481* (PE, W); Liang Shan, *Exped. Pl. Med. Sichuan 27961* (NAS); Emei Hsien, *Exped. Pl. Med. Sichuan 13228* (NAS); Hongxi Hsien, *C. T. Guan 6894* (PE); Emei Hsien, *Y. Y. Ho 5060* (NAS); Mt. Omei-shan, *E. Faber 71296* (US), *W. P. Fang 2805* (E); Shimian Hsien, *C. C. Hsieh 41977, 42033* (PE); Kangding Hsien, *C. P. Huang 1852* (PE); Honton R., *Potanin in 1885* (K, LE, P); Baoxing Hsien, *T. P. Soong 39263* (PE); Emei Hsien, *T. Tang & F. T. Wang 23310* (NAS), *T. H. Tu 476* (NAS, PE); Mt. Omei-shan, *F. T. Wang 23310* (GH), *E. H. Wilson 5767* (BM, P); Nanchuan Hsien, *J. H. Xiong 92550* (PE); Ebian Hsien, *C. W. Yao 2839* (NAS, PE); Leibo Hsien, *T. T. Yü 3685* (PE). XIZANG (Tibet): Meto Hsien, *Kokonor-Tibet Exped. 74-4902*

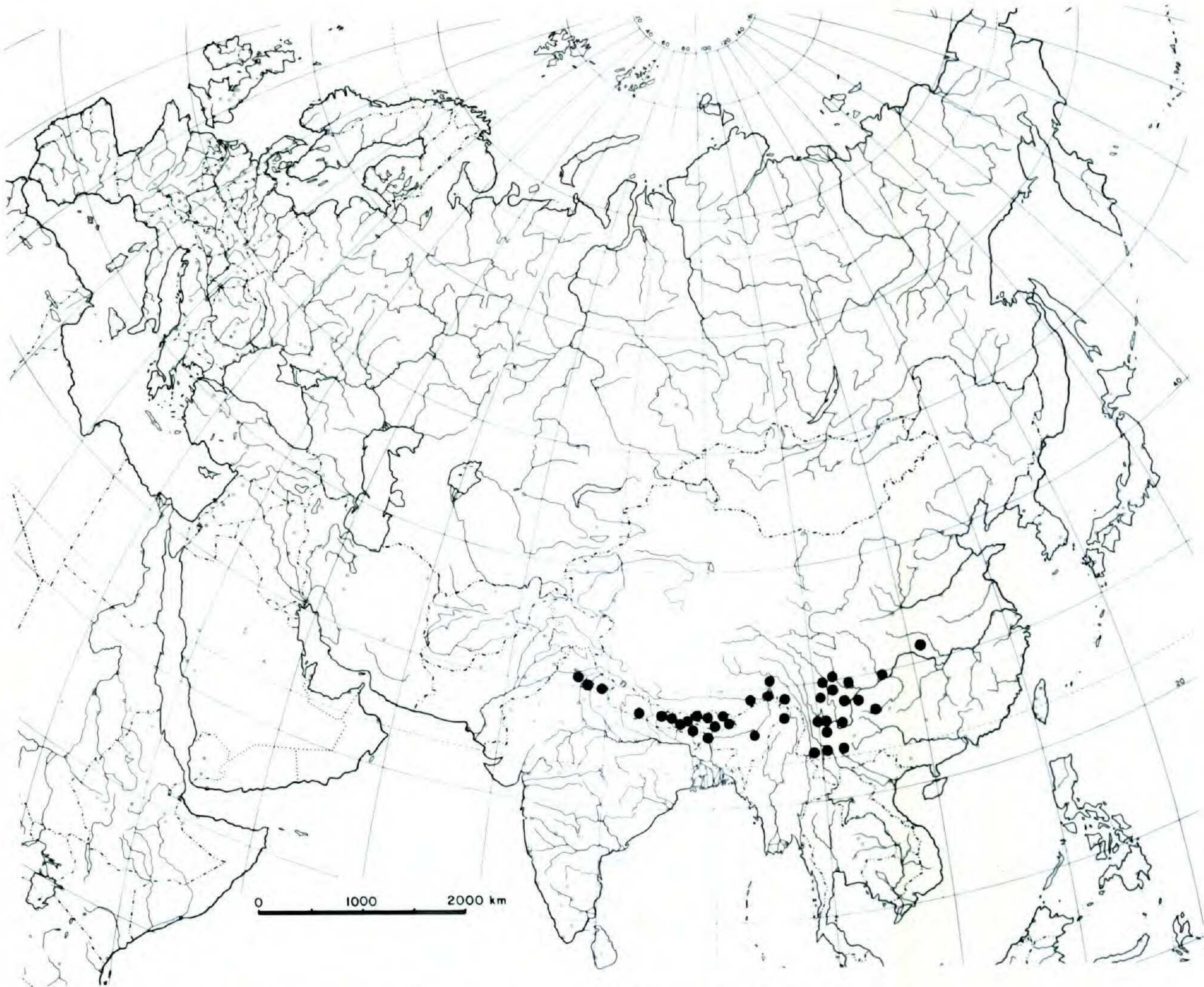


FIGURE 17. Distribution of *Circaea repens* Wall. ex Asch. & Magnus.

(PE); Milin Hsien, *Chin. Med. Exped.* 3746 (PE); Nyalam Hsien, *Chin. Med. Exped.* 1183, 1257 (PE); Nyingchi Hsien, *Chin. Med. Exped.* 3594 (PE); Medog, *Qinghai-Xizang Exped.* 744902 (PE); Zayu, *Qinghai-Xizang Exped.* 73827 (PE); Milin Hsien, *Qinghai-Xizang Exped.* 741941 (PE); Nyingchi, *P. C. Tsoong* 3594 (PE); Tangmei Hsien, *T. S. Ying & D. Y. Hong* 755 (PE); Cona Kian, *Xizang Exped.* 751706 (PE). YUNNAN: San-tchang-kiou, Ho-kin, *P. Delavay* 118 (P), 991 (A, MO, P, US); Pei-tsao-long-shan, *J. Delavay* 6638 (K, MO, P); Liang-wang-shan, *J. Delavay* 6903 (MO, P, US); Tong-tchouan, *F. Ducloux* 244 (NY, UC), 1421 (E), 5395 (P), 6401 (P); E flank of the Lichiang Range, *G. Forrest* 6261 (BM, E, S); Tong-tchouan, *E. E. Maire s.n.* (W), in 1912 (G); Pe-long Tsin, *E. E. Maire in 1913* (G, P); Ten-choin-lin, *E. E. Maire* 341 (E); Te-niou-kuen, *E. E. Maire* 2991 (NY, UC); Chou-ke-suin, *E. E. Maire* 3992 (UC); Talifu region, *C. Schneider* 3098 (G, GH, K); Qiaojia Hsien, *B. S. Sun* 948 (PE); "Yunnan," *T. T. Yü* 7469 (A).

INDIA. ASSAM: Naga Hills, Japvo, *D. N. L. Bor* 6444 (BM); above Ginjia, *J. R. Reid in 1885* (E). HIMACHAL PRADESH: Simla, *H. Collett in 1862?* (K), *C. B. D. s.n.* (E), *Dalhousie s.n.* (G); Simla, Cheop Forest, *G. Watt* 7949 (E). SIKKIM: Lata, *H. Cave in 1912* (BM); Yumtang, *H. Cave* 179 (K); Nubay, *C. B. Clarke* 25324 (K); Lachen, *R. E. Cooper* 395 (BM, E); Darjeeling, *J. M. Cowan s.n.* (E); Darjeeling, Gatribas, *H. Hara in 1964* (TI); Lachen, *J. D. Hooker in 1849* (K); 7-10,000 feet, *J. D. Hooker s.n.* (G, L, W); Gangri, *Dr. King's collector in 1887* (B); Chungtang, *Smith & Cave* 2608 (B). UTTAR PRADESH: Nainital Cheena Peak, *P. Sehgal* 57 (US); Kumaon, *R. Strachey & J. E. Winterbottom 1* (BM, GH, KP). STATE UNKNOWN: Jumna Valley, *J. F. Duthie* 1048(G); "Himal. Bor. Occ., 7-800 feet," *T. Thomson s.n.* (BM, G, GH, K, W); Tapa, *T. Thomson in 1849* (K); Tachoong, *T. Thomson in 1849* (G).

NEPAL. Chhange, *Banerji & P. R. Sakya* 5750 (BM); Sheopuri, N of Kathmandu, *C. Chuma in 1970* (TI); Sinduwa, Dhankuta Dist., *H. Hara et al. in 1963* (TI); Batasay-Halhale, Bhangjang-Bhuspate Danra, *H. Hara et al. in 1963* (TI); Murhay, *H. Hara et al.* 6300555 (TI); Sinduwa-Chitray, *H. Hara et al.* 6300556 (KYO, TI); Rhikheswore, *S. B. Malla* 229 (BM); Bagmati zone, before Syarpa-



gaon, N side of Langtang R., *D. Nicolson* 2434 (US); Ganja La-Palchok Danda, *O. Polunin* 1955 (BM); Golphubhanjang, *Shocollia & Sakya* 3762 (BM); Mewa Khola, Tamur Valley, *J. D. A. Stainton* 1308 (A, BM, E, UPS); Nr. Gurjakhani, *J. D. A. Stainton et al.* 3658 (BM, G, P); Mardi Khola, *J. D. A. Stainton et al.* 8420 (BM, E, UPS); Milke Bangyang, *L. H. J. Williams* 1113 (BM); between Hururu & Num, Joljale Himal., Arun Valley, *T. Wraber* 148 (BM); Yaba to Jiri, above Sikrigaon, without collector in 1964 (A).

PAKISTAN. Chor, *R. C. s.n.* (LIV).

*Circaea repens* is recognized by the distinctive, deeply notched, V-shaped petals, unilocular ovaries and fruits, a nectary wholly within the floral tube, and by slender rhizomes with terminal, tuberous thickenings. *Circaea repens* resembles species with bilocular fruits in size and general appearance but is similar to the unilocular *C. alpina* in flower and fruit characters.

Ascherson and Magnus (1870) were the first to point out that the unilocular fruits could be used to separate *Circaea repens* from *C. lutetiana*. They failed to notice that the equally important character of presence or absence of an exerted nectar-secreting disc could also be used. Handel-Mazzetti (1933) was the first to point out that *C. repens* lacks a prominent disc, which is always present in *C. lutetiana*.

Wallich's collections, 6341 and 6342, in his Numerical List (1832), differ only in that 6341, which he called *Circaea repens*, is taller and with longer pedicels than his 6342, which he thought to be Ehrhardt's *C. intermedia*. C. B. Clarke (1879), evidently without close examination of the flowers and fruits, assumed that the larger plants were identical to *C. lutetiana*, which they superficially resemble. Clarke did recognize that the smaller plants (6342) were different from *C. intermedia* but thought that they were closely allied to *C. alpina*, differing only in the pubescence of the stem. The specimen annotated by Clarke as *C. alpina* var. *himalaica* (K) differs somewhat from most specimens of *C. repens* in that its leaves are more crowded and cordate at the base, as is usual in *C. alpina* subsp. *alpina*.

*Circaea repens* appears to occupy an intermediate position in the genus, linking the bilocular and unilocular species. It resembles the former in stature, in holding the flowers perpendicular to the raceme axis at anthesis, and in appearing to be outcrossing. The unilocular fruits and ovaries and the formation of tubers at the tips of the rhizomes link it to the latter. It can also be seen in freehand sections that the fruit bears a trace of a second locule represented by a darkened line. The functional locule is located obliquely towards one side of the fruit. No trace of a second ovule is evident in freehand sections.

One collection from Bhutan, Dotena Limpu, *R. E. Cooper* 3302 (BM, E), is unusual in that the inflorescence, pedicels, and buds are entirely glabrous. The characteristic petals and fruits, however, leave no doubt that the plants are *Circaea repens*. Some plants from Emei Shan, Sichuan, have the petals with a more shallow apical notch, shorter pedicels in flower and fruit, and shorter fruit plus pedicel length. Plants from China often have thicker and more prominently denticulate leaves. Plants from China and N Burma consistently lack bracteoles.

## 7. *Circaea alpina* L., Sp. Pl. 9. 1753.

Erect, or decumbent at the base and rooting at the nodes, 0.3–5 dm tall, simple or branched above or occasionally bushy-branched from near the base. Plants

forming numerous filiform rhizomes, each producing late in the season a tuberous thickening at the apex; the tubers giving rise to the following year's plants from their apices and to the following year's rhizomes from their nodes; filiform rhizomes occasionally arising from the lowermost nodes of the stem and then arching and ultimately becoming subterranean and tuber-forming, the aerial portions of the rhizomes occasionally with the scale-like leaves enlarged and similar to the stem leaves. Plants ranging from completely glabrous (populations of *C. alpina* subsp. *alpina*) to pubescent throughout (most populations of *C. alpina* subsp. *imaicola*). The stem with short, soft, falcately recurved hairs 0.1–0.2 mm long; the axis of the inflorescence with short capitate and clavate-tipped glandular hairs or with hairs as on the stem, or with an admixture of the two; the petioles with soft, short, upwardly curved, falcate hairs, these sometimes continuing along the veins above, and occasionally below, and also on the interveinal areas above, sometimes also with strigillose hairs admixed. Stems most commonly green, occasionally the nodes purple, rarely the entire stem purple (*C. alpina* subsp. *angustifolia* commonly has the axis of the inflorescence purple and the stem green). Leaves horizontally spreading, light green and translucent (in *C. alpina* subsp. *alpina*, *micrantha* and *pacifica*) or deep green and opaque (in *C. alpina* subsp. *angustifolia*, *caulescens*, and *imaicola*) or, in plants from the Himalayan region and China, with the area along the veins green and the interveinal areas red pigmented. Leaves near the summit of the stem the largest, (1–)1.5–6(–11) cm long, 0.7–5.5(–8) cm wide, abruptly reduced in size upward to the base of the inflorescence and ultimately bractlike and alternate, gradually to abruptly reduced downward, distantly to closely spaced and then appearing somewhat whorled. Leaf shape highly variable, from narrowly trullate or elliptic to nearly circular, acute to short acuminate at the apex, very narrowly cuneate to cordate at the base, subentire to very sharply serrate. Petioles 0.3–3(–4) cm long, terete or semiterete (in *C. alpina* subsp. *alpina*, *micrantha*, and *pacifica* the petiole is often flattened in pressing and appears winged), glabrous to densely pubescent with short, soft, upwardly curved, falcate hairs 0.1–0.2 mm long; with, or occasionally without, reduced branches arising in the axils. Inflorescence glabrous to densely pubescent with capitate and clavate-tipped glandular hairs 0.1–0.2 mm long or with soft, short, falcately recurved hairs 0.1–0.2 mm long, or with an admixture of the two; terminal on the main stem and simple or, more commonly, with one or more lateral branches from the base of the terminal raceme and at the tips of short axillary branches or arising directly from the axils of the uppermost leaves; the lateral branches alternate or opposite and subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, 0.7–2 cm long at initiation of flowering, to 12(–17) cm long at cessation of flowering; the lateral racemes 0.8–3 cm long at initiation of flowering, to 9(–15) cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicel 0.7–3.5 mm long, perpendicular to the axis of the raceme (in *C. alpina* subsp. *caulescens* and some plants of subsp. *angustifolia*) to ascending or erect (in *C. alpina* subsp. *alpina*, *imaicola*, *micrantha*, *pacifica*, and some plants of *angustifolia*), glabrous or very rarely with a few, short, capitate and clavate-tipped glandular hairs ca. 0.1 mm long; with a minute setaceous bracteole, 0.1–0.4(–0.6) mm long at the base or (in *C. alpina* subsp. *caulescens* and some plants of subsp. *pacifica*), the bracteole lacking. Fruiting pedicels 1.5–5.2 mm

long. Buds glabrous, or very rarely glabrescent, with very short, soft, straight hairs ca. 0.1 mm long; white, pink, or purple-tinged apically or the entire bud pink or purple; elliptic to broadly so, ovate to broadly obovate in outline, smoothly rounded to the obtuse or minutely mammiform apex; from the summit of the ovary, 0.8–2.6 mm long, 0.4–1.3 mm thick just prior to anthesis. Ovary 0.5–1.5 mm long, 0.3–0.7 mm thick at anthesis, slenderly clavate to obovate in outline, glabrous (in *C. alpina* subsp. *micrantha*) or, more commonly, densely covered with short, soft, translucent, uncinata hairs. Floral tube from a mere constriction between the ovary and the base of the sepal lobes to 0.5(–0.6) mm long, 0.1–0.3 mm thick at the narrowest point, funnelform to very broadly so. Sepals 0.8–1.8 (–2.2) mm long, 0.6–1.3 mm wide, glabrous, white or pink, occasionally purple-tinged apically or rarely purple throughout; oblong, ovate to broadly so or triangular ovate, rounded to the obtuse or minutely mammiform apex; spreading perpendicularly to the ovary or slightly reflexed. Petals 0.6–2 mm long, 0.6–1.8 mm wide, from longer than broad to slightly broader than long; white, narrowly obtriangular, obdeltoid, obovate to broadly so to depressed obovate in outline; the apical notch essentially lacking to 0.7 mm deep, to  $\frac{1}{2}$  the length of the petal, the petal lobes rounded to truncate, or rarely the apices somewhat crenulate (in *C. alpina* subsp. *angustifolia*). Stamens erect, ascending or, less commonly, spreading at anthesis, as long as or slightly longer than the style; filaments 0.7–2.2 mm long; anthers 0.2–0.4 mm long, 0.2–0.4 mm thick, most commonly dehiscent before the buds open. Style straight, erect, 0.6–2.3 mm long, topped by an obtriangular to transversely oblong, bilobed stigma 0.1–0.4 mm tall, 0.15–0.5(–0.7) mm thick. Nectar-secreting disc wholly within the floral tube and inconspicuous. Mature fruit 1.6–2.6 mm long, 0.5–1.2 mm thick, clavate or obovate (in *C. alpina* subsp. *angustifolia*), rounded to subtruncate at the apex, tapering smoothly into the pedicel; unilocular and 1-seeded, without ribs or sulci but with the pedicel extending as a shallow groove along the upper surface; densely covered with soft to stiff uncinata hairs 0.2–0.5 mm long, these translucent or containing purple pigments (in *C. alpina* subsp. *angustifolia* and some plants of subsp. *micrantha*), and with fewer, short, clavate-tipped capitate hairs intermixed. Fruiting pedicels horizontally spreading perpendicular to the raceme axis to slightly deflexed at maturity. Combined length of pedicel and mature fruit, (3.5–)4–7.8 mm long. Gametic chromosome number,  $n = 11$  (unknown in *C. alpina* subsp. *micrantha*).

Distribution: Moist places and on moss-covered rocks and logs, cold temperate and boreal forests at high latitudes and altitudes throughout the northern hemisphere to 70° N. Lat., extending into the subtropics and tropics at high elevations in southern Asia. From near sea level to 5,000 m. Flowering, mid-April to mid-September and sporadically to mid-October.

*Circaea alpina* can be distinguished from other species of the genus primarily by its unilocular, 1-seeded fruits, which lack any trace of a second locule. The species that most closely resembles *C. alpina* is *C. repens* of the Himalayan region, but the latter species is more robust and coarser, has a trace of a second locule in the fruits, has petals that are cleft more than half way to the base, and,

although the character is not as reliable, has leaves with 9–15 secondary veins while *C. alpina* has leaves with 5–10 secondary veins. Both *C. alpina* and *C. repens* bear tubers at the ends of the rhizomes and are the only species of the genus to do so.

In this treatment *Circaea alpina* is recognized as an inbreeding complex of six subspecies, each exhibiting different geographical or ecological preferences but with areas of overlap between two or more subspecies through parts of their range. These subspecies form a reticulate pattern of morphologically intergrading populations, some of which are separated only by seemingly minute differences. In other cases, were it not for numerous intermediate plants, some subspecies appear so dissimilar that it would be easily justifiable to recognize them as separate species, as has often been done in the past.

Although the characters that may be used to separate the subspecies are few, they are constant within geographical and/or ecologically distinct areas. The reticulate nature of variation between subspecies makes it difficult to determine phylogenetic relationships within *Circaea alpina* but it seems highly probable that subsp. *caulescens* is the most primitive since it retains a greater number of ancestral characters. Among these are the divergent or nearly divergent posture of the pedicels at anthesis, larger flowers, robust habit, thicker leaves, and pubescent stems, all characters found in species having bilocular and 2-seeded fruits and which are predominantly outcrossing. One puzzling feature, however, is the absence of a bracteole at the base of the pedicels in *C. alpina* subsp. *caulescens*, which is present in all other subspecies of *C. alpina* and in many of the species having bilocular fruits. It seems highly unlikely that *C. alpina* subsp. *caulescens* gave rise to the other subspecies of *C. alpina* but probable that plants ancestral to subsp. *caulescens* could have done so. The widely disjunct range of *C. alpina* subsp. *caulescens* at the present time seems to indicate that at some time in the past it had a much wider distribution; it is now restricted to a few favorable habitats in the Caucasus and Altai Mountains, central and Far Eastern Asia and in disjunct areas in Japan.

Loss of pubescence, a change of pedicel posture at anthesis from divergent to ascending or erect, reduction in leaf thickness, and a reduction in size of the flowers are derived conditions and are exhibited by *Circaea alpina* subsp. *alpina* and subsp. *micrantha*. The extreme narrowing of the leaves and the trend toward narrowly cuneate leaf bases in *C. alpina* subsp. *angustifolia* is also an advanced condition, but subsp. *angustifolia* remains primitive in bearing the flowers on divergent pedicels in many plants. *Circaea alpina* subsp. *angustifolia* intergrades with subsp. *imaicola* and it may possibly be that the divergent pedicels at anthesis in subsp. *angustifolia* are secondarily derived.

*Circaea alpina* is predominantly self-pollinating but with some degree of outcrossing as evidenced by the numerous hybrids between it and several of the species that bear bilocular fruits. In all cases where plants of *C. alpina* were observed in the field and in the greenhouse the anthers dehisce while still in the buds and while appressed to the stigma (see also Raven, 1963, and Haber, 1967, 1977). This adaptation apparently has helped *C. alpina* to occupy less favorable areas at high latitudes and altitudes where availability of insect visitors is often

lacking or reduced due to frequent periods of unfavorable weather. During long periods of cold, cloudy, or rainy weather effective pollination may occur, with the inflorescence elongating, the ovaries maturing, and the floral tube eventually dropping without the buds ever opening. This is certainly the case in *C. alpina* subsp. *alpina* in North America and in subsp. *imaicola*, which I observed during a period of very cold, rainy weather in the high mountains of Taiwan. The situation was different in plants of *C. alpina* subsp. *caulescens* in Japan on Hokkaido during a period of similar weather. In this subspecies all flowers opened despite the cold weather even though buds on plants of subsp. *alpina* that were growing nearby remained closed. *Circaea alpina* subsp. *caulescens* grows at relatively lower altitudes and/or latitudes than other subspecies and, as Skvortsov (1970a) has pointed out, and my own observations in Japan confirm, seems to prefer somewhat warmer habitats.

The critical temperature below which the buds of *Circaea alpina* subsp. *alpina* remain closed is between 14° and 16°C. This coincides closely with the lowest temperatures where activity ceases among the insects that frequently visit the flowers of *Circaea*. As temperatures rise, the buds tend to open progressively sooner after anther dehiscence and perhaps in some cases the buds may actually open shortly before anther dehiscence. The latter possibility would seem most likely in *C. alpina* subsp. *caulescens* and *angustifolia*, in which the flowers are held perpendicular to the raceme axis as in the outcrossing, less specialized species of the genus.

#### KEY TO THE SUBSPECIES OF *CIRCAEA ALPINA*

- a. Inflorescence elongating as or before the flowers open; flowers more or less loosely spaced, the lower flower-bearing pedicels perpendicular to the raceme axis at anthesis ..... b
  - b. Pedicels without a minute bracteole at the base, or the bracteole represented by a darkened gland; leaves ovate to broadly so, rounded to truncate or subcordate at the base; hairs on fruit translucent; Caucasus and Altai regions, Lake Baikal and central Far Eastern Asia ..... 7a. subsp. *caulescens*
  - b. Pedicels with a minute bracteole, 0.2–0.5 mm long, at the base; leaves elliptic to trullate or ovate, narrowly to broadly cuneate at the base; hairs on fruit containing purple pigment; southwestern China ..... 7b. subsp. *angustifolia*
- a. Inflorescence elongating after the flowers open; flowers clustered and corymbose at the summit of the raceme, the pedicels erect or ascending at anthesis ..... c
  - c. Stem pubescent, with at least a few, soft, falcately recurved hairs ..... d
    - d. Leaves thick, deep green or reddish, opaque; Himalayan region, mountains of China and southern India; Taiwan ..... e
      - e. Leaves elliptic to trullate, narrowly to broadly cuneate at the base ..... 7b. subsp. *angustifolia*
      - e. Leaves ovate, rounded to subcordate at the base, rarely broadly cuneate ..... 7c. subsp. *imaicola*
    - d. Leaves thin, pale green, translucent ..... f
      - f. Ovaries minutely pubescent at anthesis; petals conspicuously notched; western North America ..... 7d. subsp. *pacifica*
      - f. Ovaries glabrous at anthesis; petals emarginate or barely notched; Himalayan region and southwestern China ..... 7f. subsp. *micrantha*
  - c. Stem glabrous ..... g
    - g. Ovaries minutely pubescent at anthesis; petals conspicuously notched, the notch 0.3–0.7 mm deep,  $\frac{1}{4}$ – $\frac{1}{2}$  the length of the petal; wide ranging in the northern hemisphere ..... 7e. subsp. *alpina*
    - g. Ovaries glabrous at anthesis; petals emarginate or barely notched, the notch to 0.3 mm deep, less than  $\frac{1}{5}$  the length of the petal; very high elevations in the Himalayas and southwestern China ..... 7f. subsp. *micrantha*

**7a. *Circaea alpina* L. subsp. *caulescens* (Komarov) Tatewake, Veg. Shikotan Is. 44. 1940.—FIG. 18.**

*Circaea alpina* L. var. *imaicola* Asch. & Magnus, pro parte, Bot. Zeitung (Berlin). 28: 750. 1870.

*Circaea alpina* L. var. *caulescens* Komarov, Fl. Mansh. 3: 99. 1905.

*Circaea imaicola* (Asch. & Magnus) Hand.-Mazz., pro parte, Symb. Sin. 7: 603. 1933.

*Circaea caulescens* (Komarov) Nakai ex Hara, J. Jap. Bot. 10: 588. 1934.

*Circaea caulescens* (Komarov) Nakai ex Hara var. *robusta* Nakai ex Hara, J. Jap. Bot. 10: 589. 1934. TYPE: Korea, Province Kogen, Mt. Kongo-san, 7 August 1916, T. Nakai (TI, holotype).

*Circaea caulescens* (Komarov) Nakai ex Hara var. *pilosula* Hara, J. Jap. Bot. 10: 589. 1934. TYPE: Japan, Honshu, Prefecture Nagano (Prov. Shinano), Wada-toge Pass, 23 July 1880, J. Matsumura (TI, holotype).

*Circaea alpina* L. var. *pilosula* (Hara) Hara, J. Jap. Bot. 20: 326. 1944.

*Circaea* × *dubia* Hara var. *makinoi* Hara, J. Jap. Bot. 34: 317. 1959. TYPE: Japan, Honshu, Prefecture Tokyo (Prov. Musashi), Mt. Takao, 1921, T. Makino (MAK, holotype; S, TI, isotypes).

*Circaea caucasica* Skvortsov, Bull. Glavn. Bot. Sada, Moskva 77: 34. 1970. TYPE: U.S.S.R., Prov. Krasnodor (Olin Kuban), in Teberda R. valley, ca. 1,250 m, 2 July 1907, E. A. Endaurova (LE, holotype, not seen).

Plants 0.5–3.5 dm tall. Stem pubescent with short, soft, falcately recurved hairs 0.2–0.3 mm long, the petioles with similar but upwardly curved hairs, at least in lines along the upper surface, the leaves also with similar hairs along the main veins and frequently also on the interveinal areas on the upper surface. The stem, and less often the petiole, firm, terete, remaining unflattened in pressing, or occasionally the petioles flattened and appearing winged. Stem green or occasionally the nodes purple. Leaves deep green or bluish green, opaque; those between the middle and the summit of the stem the largest, 1.2–4.5 cm long, 0.6–3.5 cm wide; gradually to abruptly reduced upward to the base of the inflorescence and eventually bract-like, gradually to abruptly reduced downward, infrequently the leaves clustered near the summit of the stem and appearing whorled. Leaves ovate to broadly so to nearly deltoid, acute to short acuminate at the apex, rounded or truncate, less commonly subcordate or cordate at the base, shallowly to prominently dentate, the apex of the teeth commonly blunt; glabrous or, more frequently, pubescent along the main veins, and usually also on the interveinal areas above, with soft, short, falcate or strigillose hairs 0.1–0.2 mm long, also with slightly curved to falcate cilia along the margins. Petiole 0.5–3 cm long, subterete to terete, pubescent, at least in lines along the upper surface, with short, soft, upwardly curved falcate hairs 0.1–0.2 mm long; with or without reduced branches arising in the axils. Inflorescence glabrous or, rarely, with sparse, capitate and clavate-tipped glandular hairs ca. 0.1 mm long; terminal on the main stem and upper axillary branches, rarely at the tips of axillary branches arising from the base of the stem. The inflorescence simple or, more commonly, with alternate or opposite lateral racemes from the base, these subtended by reduced leaves or leaflike bracts. Flowering pedicels glabrous, 1–3.5 mm long, ascending or diverging perpendicular to the axis of the raceme; the flowers opening during or after the elongation of the raceme and ± widely spaced; with a minute setaceous bracteole, 0.1–0.2 mm long at the base or, more commonly, the bracteole absent and represented by a short, glandular process. Fruiting pedicels 2.5–3.8 (–5) mm long. Buds glabrous, ovate to very broadly elliptic to obovate in outline, obtuse or, less commonly, minutely mammiform at the apex; from the summit of the ovary, 1.3–2.2 mm long, 0.8–1.3 mm thick; white or pink, commonly purple

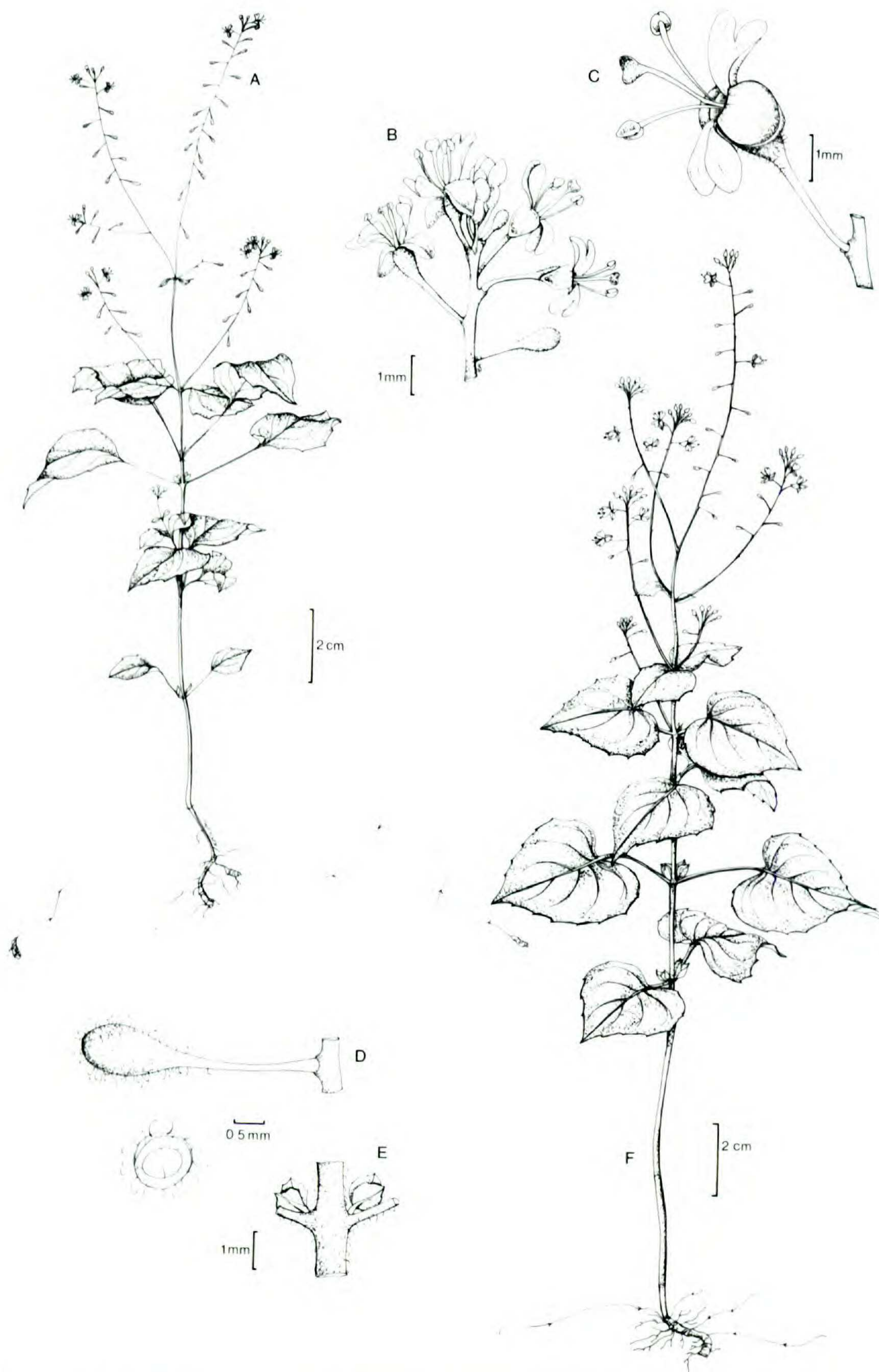


FIGURE 18. *Circaea alpina* L. subsp. *caulescens* (Komarov) Tatewake.—A. Habit.—B. Inflorescence.—C. Flower.—D. Fruit.—E. Mid-stem node. From Boufford & Wood 1978 (CM, KYO, MHA, MO, PE, UC).—F. Habit of plant from the Caucasus. From Skvortsov in 1976 (MO).

tinged at the apex. Ovary 0.7–1.1 mm long, 0.3–0.6 mm thick at anthesis, clavate to narrowly so; pubescent, with soft, short, translucent, uncinuate hairs. Floral tube 0.2–0.4 mm long, 0.1–0.2 mm thick at the narrowest point, funnellform to very broadly so. Sepals (1–)1.4–1.9 mm long, (0.6–)0.8–1.3 mm wide, white or pink, commonly tinged with purple at the apex; narrowly to broadly ovate or oblong ovate, rounded to the obtuse or, rarely, minutely mammiform apex. Petals (0.9–)1.4–2 mm long, (0.9–)1.2–1.9 mm wide, from longer than wide to wider than long, white or pink, obovate to depressed obovate or obdeltoid in outline, the apical notch 0.4–0.7 mm deep,  $\frac{1}{3}$ – $\frac{1}{2}$  the length of the petal; the petal lobes rounded. Filaments 1.8–2.2 mm long; anthers 0.2–0.4 mm long, 0.3–0.4 mm thick. Style 1.8–2.5 mm long; stigma 0.2–0.4 mm tall, 0.2–0.5 mm thick. Mature fruit clavate, 1.8–2.6 mm long, 0.7–1.1 mm thick, the translucent uncinuate hairs 0.3–0.4 mm long. Combined length of pedicel and mature fruit, 5–6.2(–7.9) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: China, in the valley of the Yalu River, 10 July 1897, V. Komarov (LE, lectotype).

Distribution (Fig. 19): Moist places, on moss-covered rocks and logs or in drier soils in cool temperate deciduous and mixed forests and the lower part of boreal forests. Japan (Hokkaido, mountains of central Honshu and Mt. Kurotakiyama, Shikoku); Korea, northeastern and east-central China and southeastern U.S.S.R.; disjunct on the south side of Lake Baikal and in the Altai and Caucasus Mountains. From near sea level to 1,500 meters. Flowers, from mid-June to mid-August and sporadically to mid-September.

#### Representative specimens examined:

##### U.S.S.R.

RUSSIAN S.F.S.R. Coast of Tatory, *Bushnell in 1856* (BM); Novina-Ompo, N. *Dessoulavy 4940* (G); from Amur to Tirma R., Lake Tyrmy, W. *Docturovsky 1279* (UC); Sajon, Urika R. near Angari R., W. *Hudgera, Krivotulenko 580* (ALTA); Primorski Prov., Spassk-Dolny Dist., V. *Dvorakovskaya & L. Vavilova in 1973* (MHA); Amur, Oettu, C. *Maximowicz in 1859* (L); Khabarovsk Prov., near Khekhtsurkiya, A. *Nechayev 38* (MHA); Khabarovsk Prov., Sovetskaya Dist., Gavan, near Tubutchi Station, A. *Nechayev 158* (MHA); Lake Klepochnoi (Suifuna), M. N. *Nefelova & R. A. Pashchenko in 1952* (MO); Primorski Prov., Terney Dist., Sichote-Alin Reservation, *Shemetova 1190a* (MHA); Primorski Prov., vicinity of Vladivostok, A. K. *Skvortsov in 1967* (MO); N Caucasus Mts., Kabardino-Balkaria, near Chegem, A. K. *Skvortsov in 1976* (MO); Altai, NW extremity of Teletskoye Lake, A. K. *Skvortsov in 1977* (MO); Primorski Prov., Cape Gamov, G. *Smirnova 2211* (DS); Vladivostok & vicinity, D. *Topping 2292* (US); Vladivostok Dist., Vladivostok, *Voinovich & Kriger in 1910–1914* (MHA); Primorski Prov., Terney Dist., near Amgu, V. N. *Voroshilov in 1969* (MHA); Primorski Prov., Svetlaya, V. N. *Voroshilov 507* (MHA); Khabarovsk Prov., Lazo Dist., SE of Khabarovsk, Bitcheraya, V. N. *Voroshilov 12501* (MHA); Primorski Prov., Chasan (Khasan) Dist., Cape Gamova, V. N. *Voroshilov 6530* (MHA); "Coast of Manchuria, lat. 44–45° N," C. *Wilford in 1859* (GH, K, S, US); Primorski Prov., Sutschan Dist., near Ustschanovka, *without collector in 1969* (MO).

##### ASIA

CHINA. ANHUI: Mt. Huang-shan, C. *Chien 1221* (W), R. C. *Ching 4230* (UC), T. N. N. *Liou & P. C. Tsoong 3151* (PE), H. *Wissmann in 1936* (W). HEBEI: East Tomb, H. F. *Chow 40677, 40733* (PE); Beijing ("Peking"), A. *David in 1863* (BM); Zhaulu Hsien, W. Y. *Hsia 2353* (PE), Tung-ling, East Tomb, C. F. *Li 11215* (NAS, NY, PE); Xiaowutai Shan, T. C. *Li 2668* (PE); Laiyuan Hsien, K. M. *Liou 2903* (NAS, PE), 3180 (PE); Fuping Hsien, K. M. *Liou 3058, 3586* (PE); Wuling Shan, T. N. *Liou 6955* (NY); East Tomb, T. N. *Liou 6956* (PE); Neiqui Hsien, H. Y. *Liu 555* (NAS); Chih-li, Po-hua Shan, J. C. *Liu 1132* (UC); Neiqui Hsien, Xiaowutai Shan, Y. *Liu 13146* (NAS, PE); Mt.



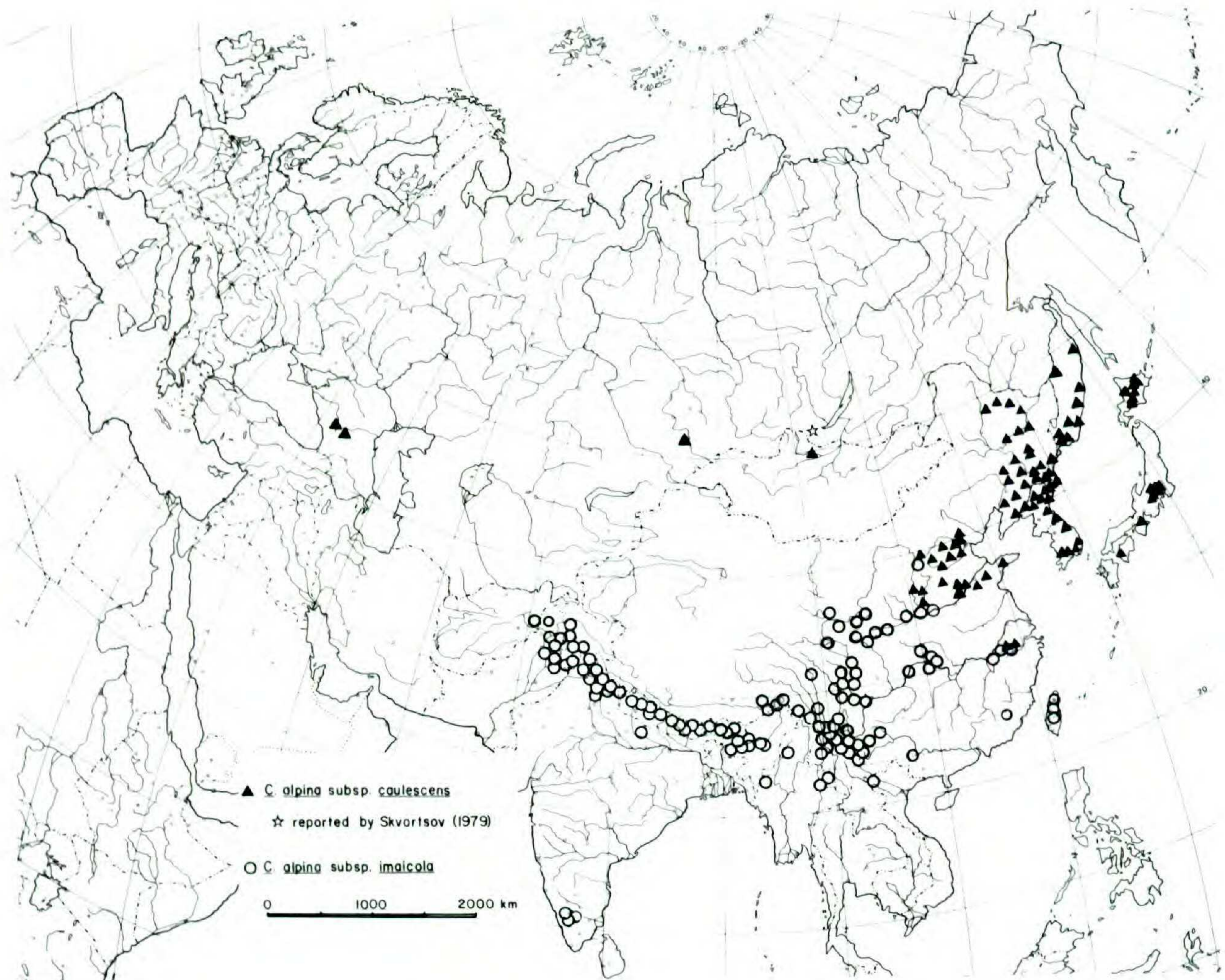


FIGURE 19. Distribution of *Circaea alpina* L. subsp. *caulescens* (Komarov) Tatewake (solid triangles; report by Skvortsov (1979), solid circle), and *C. alpina* L. subsp. *imaicola* (Asch. & Mag.) Kitamura (open circles).

Murei, Sansei-sho, *I. Miyake s.n.* (TI); Ch'eng-te, Mt. Murei, *T. Nakai et al. in 1933* (TI); Chih-li, Pai-t'a, *H. Serre 2598* (W); Xiaowutai Shan, Yang-kia-p'ing, Yung-lin, *H. Smith 639* (LD, S, UPS); Nekka Prov., Mt. Murei-san, *M. Takahashi in 1933* (TNS); East Tomb, *H. T. Tsai 50304* (PE); Pao-feng-tze, Baihua Shan, *C. W. Wang 60172* (PE), 60840 (A, PE), 61689, 61802 (PE); Xiaowutai Shan, *C. W. Wang 61820* (PE); Wuling Shan, *W. C. Wu & C. Y. Yang 59* (PE); Xiaowutai Shan, *W. C. Wu 2681* (PE); Bohua Mt., *Y. Yabe in 1905* (NAS); Baxing Hsien, *C. Y. Yang 1015* (PE). HEILONGJIANG: I-ch'un Hsien, Wu-ying, *T. T. Chung & C. O. Liu 7864* (PE); Xiao Hinggan Ling, *W. Z. Fang 479* (NAS); at R. Mai-ho super, *N. Kozlow 14434* (W); near Shitokheza Station, *D. Litvinov 2066* (NY); Koandei-san, Siao Hingua Ling, San-ko-sho, Tangwang-ho, *S. Nakao in 1943* (KYO); Yichun Hsien, *Sino-German Exped. 7864* (PE); Dailing, *C. S. Sung 192* (PE); near village of Laochunlatun; *K. C. Wang 603* (LE); Harbin city, *B. C. Wu in 1959* (NAS); Tung-pei Tui, without collector (PE-315740). JILIN: from Mukden to Kirin, Chang-pei-shan and to Tang-ho-ko, *H. E. M. James in 1886* (K); Omoso Dist., U-cre-sun-che valley, *V. Komarov in 1896* (BM); Ninguta Dist., Czau-lin Mts., *circa* Taimagou, *V. Komarov in 1896* (K); Omoso Dist., Eze-sun-che valleys, *V. Komarov 1138* (TI); Lao-ye-ling, *E. Licent 8505* (BM); Changbai Mt., *T. N. Liou 1719* (NAS); Dailing, *C. S. Sung s.n.* (PE); Changbai Shan, *J. J. Xian 420, 476* (PE). LIAONING: Fusong Hsien, *Y. L. Chang 141, 230, 314* (PE), *T. N. Liou 1353* (PE); "Port Bruce," *C. Maximowicz in 1860* (K, NY); Hentauhetze, *B. V. Skvortsov in 1937* (GH); "Liaoning," *Z. Y. Wu 1353* (NAS). SHANDONG: 500 km S of Beijing ("Pekin"), *L. Chanet & J. H. Serre 2598* (P); Fei Hsien, Mt., Meng Shan, *T. Cheo & L. Yen 343* (GH); T'ai-an-fu, Mt. Tai Shan, *M. S. Clemens 1450* (E); "San-ton Prov.," *U. Nagai 56* (TI); Tai Shan, *S. C. Tsui 75* (PE); Lao Mt., *Y. Yabe in 1919* (NAS); summit of Mt. Tai Shan, *Y. Yabe in 1925* (TI). SHANXI: Yuanqu Hsien, *S. Y. Bao 2239* (PE); Hsiuyuan Hsien, *K. C. Kuan et al. 839* (PE); Wutai Shan, *K. C. Kuan & Y. L. Chen 1687, 2487* (PE); Hoang-ts'ao-keou, *E. Licent 604* (BM, K, P, W); Tsiliyü at Mt. Ho

Shan, *E. Licent* 12071 (ND, W); Hsiatschuan, Mt. Yao Shan, *E. Licent* 12733 (GH, W); Yüan-ch'ü Dist., Shui-wang-p'ing, *H. Smith* 6700 (UPS); Fou-p'ing, Mei-hei-t'ouo Mt., *without collector* A192 (S). "MANCHURIA": Badao-heza valley, *V. Komarov* in 1896 (LE); at the Lu-t'a R., *V. Komarov* in 1935 (W); Khatokheza, *D. Litvinov* 2741 (UC); at the Amur R., *R. Maack* 486 (GH); "Manchuria," *C. Maximowicz & Schrank s.n.* (NY).

JAPAN. HOKKAIDO: Iburi, Tomakomai Experimental Forest of Hokkaido Univ., *D. E. Boufford & E. W. Wood* 19658 (CM, E, G, KYO, MHA, MO, PE, SHIN), 19662 (BM, CAS, CM, E, K, KYO, MHA, MO); Kushiro, Kawakami-gun, Shibeche-cho, Shibeche Experimental Forest of Kyoto Univ., *D. E. Boufford & E. W. Wood* 19761 (KYO, MO); Abashiri, Abashiri-gun, Tsubetsu-cho, NW side of Lake Chimikeppu-ko, *D. E. Boufford & E. W. Wood* 19782 (CM, KYO, MHA, MO, PE, UC), *Class of 1953* (SAP), *M. Hirano* in 1952 (KYO); Hidaka, along Chiroio R., *Y. Hoshino* in 1933 (SAP); Iburi, Tomakomai Experimental Forest of Hokkaido Univ., *M. Hotta* 16814 (KYO); Abashiri-gun, Tsubetsu-cho, Kamisato, *T. Matsuki* in 1970 (MAK); Abashiri-gun, Tsubetsu-cho, Lake Chimikeppu-ko, *T. Matsuki* in 1971 (MAK); Ishikari, Soumbetsu, *K. Miyabe & M. Tatewaki* in 1925 (SAP); Kitami, Tokoro-gun, Rubeshibe-cho, *G. Murata & Y. Momotani* 439 (KYO); Ishikari, Sounkyo, *T. Nakai* in 1928 (TI); Nopporo, *T. Tanaka* 243 (GH); Hakkan, *M. Tatewaki* in 1921 (SAP); Kushiro, Lake Kutcharo, Motoko-san, *M. Tatewaki* 20038 (SAP); Tokachi, Ashiyose, Kamiwashi-bu to Berabonaito, *M. Tatewaki* in 1951 (SAP); Ishikari, Biei to Matsuyama, *K. Togashi* in 1918 (SAP); Kitami, *K. Uno* 15696 (GH); Ogawa, *Yokoyama* in 1937 (SAP). HONSHU. NAGANO PREFECTURE: Matsumoto city, Sanjiro pasture to Mt. Chausu-yama, *D. E. Boufford et al.* 19624 (CM, KYO, MHA, MO, S); Matsumoto city, Tobira-onsen, *D. E. Boufford et al.* 19627 (CM, DS, E, KYO, MHA, MO, NCU); Suwagun, Shimo-suwa-cho, Wada-toge, *D. E. Boufford et al.* 19628 (KYO, MHA, MO); Togakushi, *U. Faurie* 1336 (KYO, P); Sugadaira, *H. Hida* in 1939 (TI); Minamisaku-gun, Kawakami-mura, from Senjogahara to Jumonji-toge, *M. Hotta* 10231 (KYO); Mt. Togakushi, *Iisiba* in 1908 (TAI); Tobira Pass, Utsukushi-gahara-kogen, Matsumoto city, *S. Ito* 636 (TNS); Suwa city, Kirigamine to Yashima, *S. Kobayashi* 1344 (MAK); Wada-toge, *J. Matsumura* in 1880 (TI); Mt. Togakushi, Hyakken, *M. Minemura* 588 (MAK); Mt. Hachibuse, *S. Momose* in 1929, in 1930 (TI); Utsukushi-gahara, *S. Momose* in 1929 (TI); Shimoina-gun, Ooshika-mura, Sawai, *M. Muramatsu* 1722 (TNS); Mt. Togakushi, *G. Murata* 6411 (KYO, SAP), *T. Nakajima* in 1913 (TUS), *H. Nishida* in 1977 (MHA, MO); Minamisaku-gun, Aiki, Mt. Ogura, *K. Ohwi* 67 (TI), *K. Sato* 800 (TI); Shinshu-toge, *D. Shimizu* in 1939 (TNS); Mt. Utsukushi-gahara, Kurumi-zawa valley, *S. Suzuki* 362 (A); Shimoina-gun, Toyama-gawa, Fukagawasa, *T. Yamazaki* in 1954 (TI); Karosawa, near Mt. Yatsuga-dake, *without collector* in 1925 (MAK 117737); Onata-gun, Mada-mura, Utsukushi-gahara, *without collector* in 1929 (MAK 117704); Mt. Togakushi-san, *without collector* in August (KAG). NARA PREFECTURE: Yoshino-gun, Mt. Ohmine, Mt. Daifu-dake, *H. Koyama & M. Hotta* 5471 (KYO, MO); Yoshino-gun, Ohmine Mts., *T. Shimizu* 4408 (SHIN). SHIZUOKA PREFECTURE: Suruga, Minami-Alps, Dentsuku-toge, *J. Sugimoto* in 1953 (TNS); Surugu, Mt. Fuji-san, *without collector* (TNS 13226). TOCHIGI PREFECTURE: Nikko, *J. Bisset* 4225 (BM, E), *H. Muramatsu* in 1923 (TI). TOKYO PREFECTURE: Minamitama-gun, Mt. Yakao, *T. Makino* in 1921 (MAK, S, TI). YAMANASHI PREFECTURE: Daibosatsu Pass, *C. Kosaka* 14 (TI); Minami-kuma-gun, Tentsuki Pass, *Matsuda & Fujita* in 1954 (TI); Mt. Azusa-yama, Azusashiraiwa, *D. Shimizu* in 1939 (TNS). SHIKOKU. KOCHI PREFECTURE: Takaoka-gun, Niyodo-mura, Mt. Kurotakiyama to Mt. Tengunomor, *G. Murata* 17303 (KYO, SHIN, US).

KOREA, NORTH. Kogen Prov., Mt. Kariou-san, *S. Hozawa* in 1941 (TNS); Kankyo-hokudo, Mt. Hakuto-zan, *T. Ishidoya* in 1931 (KYO); Kogen-do, Kongo-san, *G. Koidzumi* in 1932 (KYO); Kakyo-do, Nanyo village, *G. Koidzumi* in 1933 (KYO); N Kakyo-do, foot of Mt. Tosei-san, *G. Koidzumi* in 1933 (KYO); Heian-hokudo, Mt. Myoko, *G. Koidzumi* in 1935 (KYO); Yellow R., San-su Dist., Onkol-niuri valley, *V. Komarov* in 1897 (P); upper Yellow R., Czan-dshin-gan, *V. Komarov* in 1897 (NY); Utsuryo Island, Nanyo-do, *T. Nakai* 4460 (TI); Mt. Kongo near Matsukiri, *T. Nakai* 5686 (TI); Mt. Kambo, *T. Nakai* 7281 (TI); Kankyo-nando, Nishi-osuiri, *N. Nomura* in 1935 (KYO); Saikarei, *Y. Oguma* in 1914 (TNS); Kankyohokudo, Takado, *J. Ohwi* 2708 (TNS); Kongo-san, *S. Okuyama* in 1940 (TNS); Kankyonando, Choshin-gun, Toukamen Tounho, Ankirikoku, *A. Yamamoto* in 1934 (TNS).

KOREA, SOUTH. Kan'an, Mt. Senbutsu, *M. Honda* 39 (TI); Chollanan-do, Kwangju, *U. Hurusawa* in 1943 (TI); Pyonganpuk-do, Unsan, *T. Ishidoya* 11 (TI); See Chun Dong, *R. G. Mills* in 1910 (UC); Cho-san, *R. G. Mills* 387 (TI); Kyongsangnan-do, Mt. Chii, *T. Nakai* in 1913 (TI); Kokai, Shoto, *T. Nakai* 13302 (TI); Keishonan-do, Mt. Chii, *S. Okamoto* 17928 (KYO), 17929 (KYO, TNS), 17932 (KYO, TNS); S Chulla Prov., Mt. Chii, *Mrs. R. K. Smith* in 1928 (US), in 1934 (GH), 76 (GH, TI), 77 (TI), 685 (US); Keishonan-do, Chii-san, *K. Uno* 23366 (GH); Kangwon-do, Sepo, *without collector* 10711 (MICH).

KOREA. Localities unknown: Kangwongpuk-do, Kumgang, *M. Kobayashi* 41 (TI); Mt. Surl-ack, *I. K. Lee* in 1957 (MO); Hamkyongnan-do, S foot of Chapek Bong, *T. Nakai* 15601 (TI); Ryangkang-

do, Daehungli-sanyo, *T. Nakai* 3639 (TI); Hamkyongpuk-do, Kyongsung, Tuulonpoli, *T. Nakai* 7282 (TI); Kangwongpuk-do, Kungang, *T. Nakai* 17179 (TI); Kangwongpuk-do, Mt. Gumgang-san, *T. Uchiyama* in 1902 (TI); Shayurei, *O. Yoichiro* in 1914 (TNS).

MONGOLIA. Ta-tchiao-chan, *A. David* 2334 (P); Selenge Dist., 25 km SW of Selenge, *N. Dorofeyur* 343 (LE).

*Circaea alpina* subsp. *caulescens* is distinguished by the pubescent stems, a usually glabrous inflorescence, dark-green or bluish-green leaves that are usually pubescent above and flowers that open after elongation of the raceme axis and are held on pedicels that diverge perpendicular to the axis of the raceme. Bracteoles are most commonly lacking. In its extreme forms it approaches *C. alpina* subsp. *alpina* in one direction and subspp. *imaicola* and *pacifica* in another. *Circaea alpina* subsp. *alpina* differs from subsp. *caulescens* in having the stems completely glabrous and in having bracteoles at the base of the pedicels. In a few cases bracteoles are present at the base of a few pedicels in subsp. *caulescens* but are rarely present beneath every pedicel of a raceme. *Circaea alpina* subsp. *pacifica* differs in having thinner, pale green, translucent leaves, a glandular pubescent raceme axis, and in the position of the flowers at anthesis. In *C. alpina* subsp. *pacifica*, the flowers open before elongation of the raceme and are held in a corymbose cluster at the summit of the raceme on erect or ascending pedicels. *Circaea alpina* subsp. *imaicola* differs by having bracteoles always present at the base of the pedicels, a usually pubescent raceme axis, and in the smaller flowers held in an erect ascending position as in *C. alpina* subspp. *alpina*, *pacifica*, and *micrantha*.

The very few specimens I have seen of plants from the Caucasus Mts., which Skvortsov (1970, 1977) called *C. caucasica* (Fig. 18) are, except for being slightly larger in a few floral features, indistinguishable from *C. alpina* subsp. *caulescens*. The slightly larger fruits and sparse glands in the inflorescence and slightly longer pedicels are only minor differences that one would expect in such a widely disjunct and separately evolving population. The Siberian collection, *Dorofeyur* 343, 25 km S of Selenge (LE), is similar to the collections of Skvortsov from the Caucasus region that Skvortsov called *C. caucasica*.

Plants of *Circaea alpina* subsp. *caulescens* from Japan are generally smaller in stature than plants from the Asian mainland but usually larger than adjacent plants of subsp. *alpina* when they are found growing together. In Japan, *C. alpina* subsp. *caulescens* prefers drier and more exposed habitats than subsp. *alpina* and in central Honshu subsp. *caulescens* grows at lower elevations, usually below 1,400 meters. Skvortsov (1970) found the situation to be similar in the eastern U.S.S.R., but gave no mention of altitudinal differences. It seems likely that *C. alpina* subsp. *caulescens* had a more continuous range in Japan during the Pleistocene. With warming conditions following the last glaciation *C. alpina* subsp. *caulescens* migrated northward, where it is now fairly widespread on Hokkaido, and upward into favorable mountainous areas farther south on Shikoku and Honshu, while becoming extinct in the intervening lowland areas. Its absence from many seemingly suitable areas in other mountainous regions of Honshu is unexplainable.

**7b. *Circaea alpina* L. subsp. *angustifolia* (Hand.-Mazz.) Boufford, stat. nov.** Based on *C. imaicola* (Asch. & Magnus) Hand.-Mazz. var. *angustifolia* Hand.-Mazz., *Symb. Sin.* 7: 603. 1933.—FIG. 20.

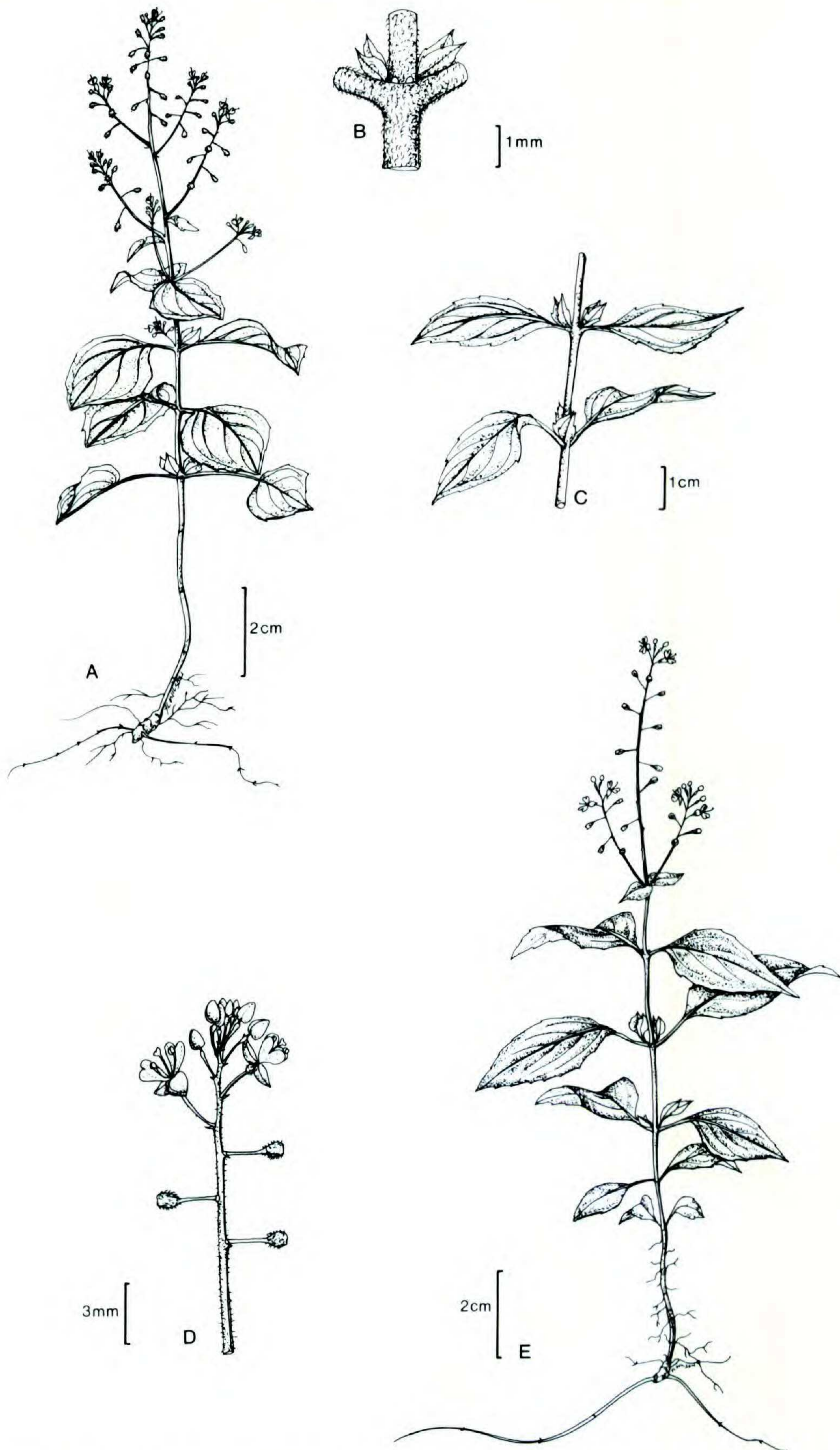


FIGURE 20. *Circaea alpina* L. subsp. *imaicola* (Asch. & Magnus) Kitamura.—A. Habit.—B. Node of stem. From *Polunin et al.* 382 (UPS). *Circaea alpina* L. subsp. *angustifolia* (Hand.-Mazz.) Boufford.—C. Stem. After *Maire* 6363 (LE).—D. Inflorescence.—E. Habit. From *Maire* 295 (BM, E).

*Circaea lutetiana* L. race *erubescens* (Franchet & Savat.) H. Lév. var. *mairei* H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 219. 1912. TYPE: China, Yunnan, mountain forests, August 1905, *E. E. Maire* 397 (UC, lectotype).

*Circaea imaicola* (Asch. & Magnus) Hand.-Mazz. var. *mairei* (H. Lév.) Hand.-Mazz., Symb. Sin. 7: 603. 1933.

*Circaea pricei* Hayata var. *mairei* (H. Lév.) Hand.-Mazz., Symb. Sin. 7: 1376. 1936.

Plants 0.7–3.5 dm tall. Stem pubescent with short, soft, falcately recurved hairs 0.1–0.2 mm long; the petioles with similar but upwardly curved hairs; the leaves also with similar hairs and sometimes with short strigillose hairs in addition; the axis of the inflorescence most commonly glabrous or with short capitate and clavate-tipped glandular hairs. Stem green or occasionally purple, firm, terete, remaining unflattened in pressing. Leaves deep green or sometimes reddened, when reddened the areas near the veins remaining lighter in color, opaque; those between the middle and summit of the stem the largest, 1.4–4.5 cm long, 0.6–2.2(–3) cm wide, becoming gradually to abruptly reduced upward to the base of the inflorescence and ultimately bractlike and alternate, gradually reduced downward, never closely spaced and appearing whorled. Leaves elliptic or trullate to broadly trullate or ovate, very rarely broadly ovate, acute at the apex, narrowly to broadly cuneate at the base, shallowly denticulate, the teeth obtusely tipped; glabrous or, more commonly, pubescent on the veins above and usually also on the interveinal areas with soft, short, falcate hairs, 0.1–0.2 mm long, and sometimes also with strigillose hairs, 0.1–0.3 mm long, intermixed, the under-surface glabrous or, less commonly, with soft, short falcate hairs along the veins; the marginal cilia nearly straight to falcate, 0.1–0.3 mm long. Petioles 0.3–1.8 cm long, terete, only slightly flattened in pressing and never appearing winged; pubescent, with short, upwardly curved, falcate hairs, 0.1–0.2 mm long; with or without reduced axillary branches arising in the axils. Inflorescence glabrous or pubescent, with short, soft, capitate and clavate-tipped glandular hairs, 0.1–0.2 mm long; terminal on the main stem and uppermost axillary branches; purple or occasionally green. The inflorescence simple or with opposite or, more commonly, alternate lateral racemes from the base, these subtended by reduced leaves or leaflike bracts. Flowering pedicels 1.3–3.5 mm long, glabrous or, very rarely, sparsely pubescent with short glandular hairs ca. 0.1 mm long; ascending or diverging perpendicular to the axis of the raceme, the flowers opening during or after elongation of the raceme and  $\pm$  widely spaced; with a setaceous bracteole, 0.3–0.5 mm long, at the base. Fruiting pedicels 2.4–5.2 mm long. Buds glabrous, from the summit of the ovary, (1.2–)1.5–1.9 mm long, 0.9–1.2 mm thick, white or pink, often purple tinged at the apex, very broadly elliptic, ovate to broadly obovate in outline, rounded at the apex. Ovary 0.6–1.3 mm long, 0.3–0.7 mm thick, clavate to obovate in outline, pubescent, with soft short, uncinuate hairs containing purple pigment, rarely glabrous at anthesis. Floral tube 0.2–0.3 mm long, 0.2 mm thick at the narrowest point, broadly to very broadly funnelform. Sepals (0.8–)1.2–2 mm long, (0.6–)0.8–1.3 mm wide; white or pink, purple tinged at the apex, less commonly purple throughout, broadly to very broadly ovate or oblong ovate, rounded to the obtuse apex. Petals (0.7–) 1.1–2 mm long, (0.6–)1–1.7 mm wide, longer than wide, white or pink, narrowly to broadly obovate in outline; the apical notch 0.2–0.4 mm deep,  $\frac{1}{5}$ – $\frac{1}{3}$  the length of the petal; the petal lobes rounded, truncate, or minutely crenulate. Filaments 0.9–1.8 mm long; anthers 0.2–0.3 mm long, 0.2–0.3 mm thick. Style 1.3–2.3 mm long; stigma 0.2–0.4 mm tall, 0.3–0.5(–0.7) mm thick. Mature fruit obovoid to clavate, rounded to

truncate at the apex, 1.6–2.5 mm long, 0.8–1 mm thick; the uncinata hairs 0.2–0.3(–0.5) mm long, translucent but containing purple pigment. Combined length of pedicel and mature fruit, 4.5–6(–7.4) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: China, Yunnan, Tung-ch'uan ("Tong-tchouan"), 2,700 m. September 1913, *E. E. Maire 1005* (E, holotype; BM, isotype).

Distribution (Fig. 21): Moist, open hillsides, thickets and forests in the mountains of southwestern China (Yunnan). Between 2,000 and 3,000 m. Flowers, July to mid-September and sporadically to mid-October.

#### Specimens examined:

CHINA. YUNNAN: Ta-li, Mt. Che-tcho-tze, Ta-pin-tze, *J. M. Delavay 1* (MO, P); Che-shan, Ki-chan, near Ta-pin-tze, *J. M. Delavay 4018* (A); Ta-ping ("Ta-pin-tze"), *J. M. Delavay 4776* (MO, P); Ch'eng-chiang ("Tchong-chan"), *F. Ducloux 239* (UC); Lan-ny-tsin near Lou-lan, *F. Ducloux 240* (UC), *F. Ducloux 6015* (P); Hsiang-yun ("Yunnan-sen"), *F. Ducloux 604* (P); La-i-chang near Lou-lan ("Lan-ny-tsin"), *F. Ducloux 1060* (E); Tou-ta, *F. Ducloux 2806* (NY); Tchong-chan, *F. Ducloux 3631* (P); Ho-ch'ing and Li-chiang valleys, *G. Forrest 562* (E); Ming-kuang valley, *G. Forrest 8637* (E, K); mountains of the Chung-tien Plateau, *G. Forrest 10860* (E, K); between Dsaodjiing and Hwadung, Dsolin-ho R., *F. Handel-Mazzetti 4969* (E, US, W); Pai-han-lo ("Bahan, pe-ha-lo"), at Salwin R., *F. Handel-Mazzetti 9577* (E, W); Mt. Tung-chuan, *E. E. Maire 295* (BM, E), *E. E. Maire 613* (BM, E), *E. E. Maire 1005* (BM, E), *E. E. Maire 2875* (NY, UC), *E. E. Maire 6363* (LE), *E. E. Maire in 1912* (G), *E. E. Maire in 1913* (G, P); humid forests on the plains, *E. E. Maire 1213* (P); on old moist moss, *E. E. Maire 2365* (E, K); K'un-ming ("Yunnan-fu"), *O. Schoch 306* (G, K); Lou-choci-tang, Yunpe, *S. Ten 87* (E, UC); Kubi, *S. Ten 1277* (W); Beyendjing, forests of Kubi, *S. Ten 1314* (W); Wei-hsi Hsien, *C. W. Wang 67687* (A); Mekong-Salwin divide, Bahanlo, *T. T. Yü 22709* (A, E).

*Circaea alpina* subsp. *angustifolia* may be recognized by its slender leaves with narrowly to broadly cuneate bases, the usually purple raceme axis, purple pigment within the uncinata hairs of the fruit, and in the flowers opening with or after elongation of the raceme so that the flowers are held on ascending or perpendicularly spreading pedicels. *Circaea alpina* subsp. *angustifolia* occurs completely within the range of subsp. *imaicola*, overlaps the range of subsp. *micrantha* in several places, and intergrades in different ways with each of these subspecies.

*Circaea alpina* subsp. *micrantha* only occasionally has the uncinata hairs of the fruits containing purple pigments but often has the raceme axis purple. Glabrous ovaries at anthesis occur commonly in subsp. *micrantha* but rarely in subsp. *angustifolia* (one example being *Maire 613*, E). *Circaea alpina* subsp. *micrantha*, however, differs in having narrowly to broadly ovate or triangular leaves with sharp, prominent serrations along the margins and with cordate bases, smaller floral parts, the petals emarginate or notched less than one fifth the length of the petal, and the raceme axes densely glandular-pubescent. The flowers are held in more or less tight clusters at the apex of the raceme on ascending or erect pedicels and open before elongation of the raceme. Plants of *C. alpina* subsp. *micrantha* usually occur at higher elevations (3,100–5,000 m) than do plants of subsp. *angustifolia*.

Plants of *Circaea alpina* subsp. *imaicola* differ in having ovate to orbicular-ovate leaves with truncate to broadly cuneate bases and the flowers clustered at

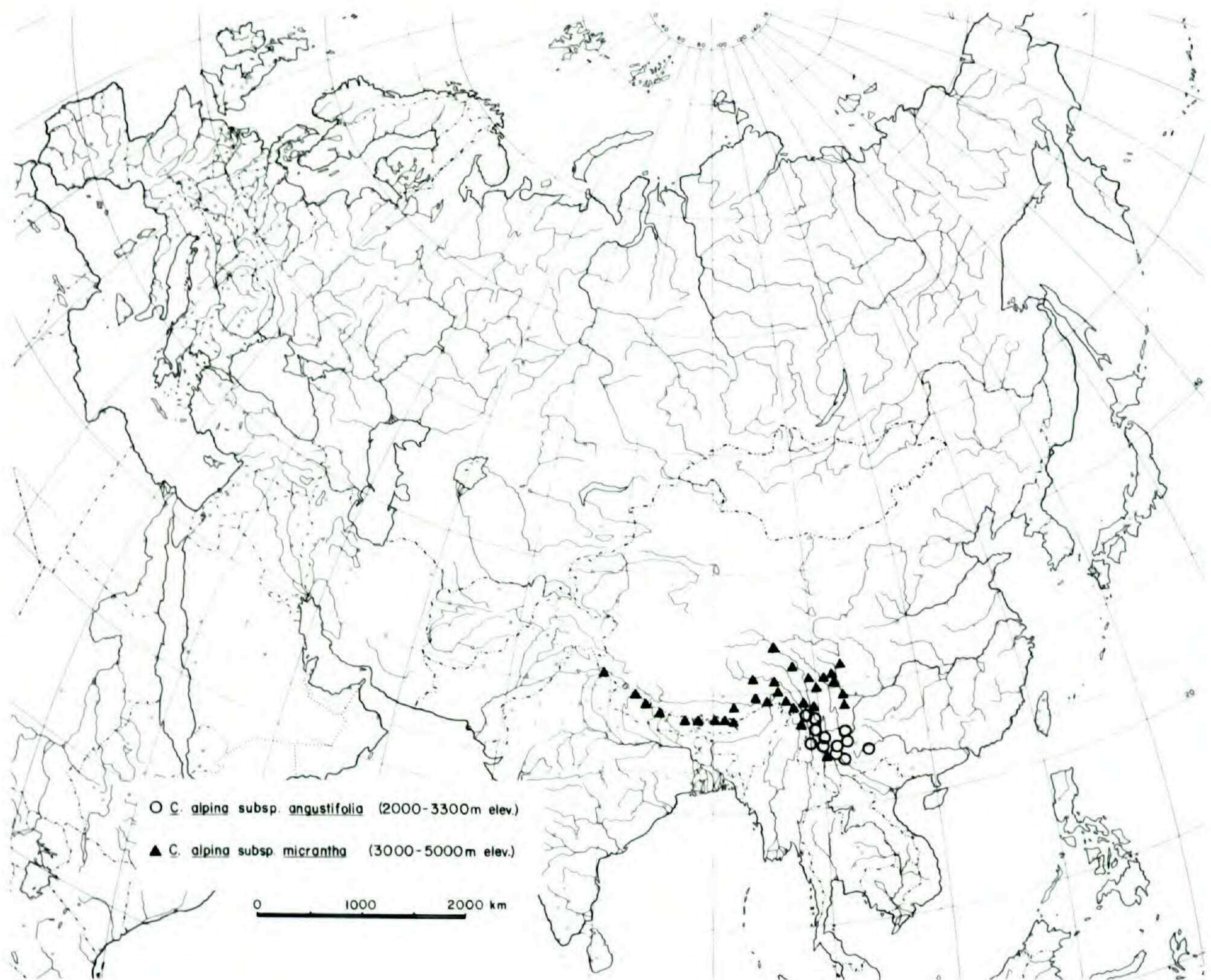


FIGURE 21. Distribution of *Circaea alpina* L. subsp. *angustifolia* (Hand.-Mazz.) Boufford (open circles) and *C. alpina* L. subsp. *micrantha* (Skvortsov) Boufford (closed triangles).

the apex of the raceme and opening before elongation of the raceme axis. The uncinuate hairs of the fruits never contain purple pigment.

*Circaea alpina* subsp. *angustifolia* resembles subsp. *caulescens* in manner of opening and size of the flowers but differs in leaf shape and in having bracteoles always present at the base of the pedicels.

Plants that Handel-Mazzetti called *Circaea imaicola* var. *angustifolia* and *C. imaicola* var. *mairei* represent two extremes of variation within *C. alpina* subsp. *angustifolia*. At one extreme are plants with very narrowly cuneate leaf bases, lanceolate leaves, pubescent stems, glandular inflorescences, and with the uncinuate hairs of the fruits without purple pigment. These grade into plants with broadly cuneate leaf bases, ovate leaves, glabrous inflorescences, and with the uncinuate hairs of the fruits containing purple pigment. In the former, some plants have the flowers borne on ascending pedicels at anthesis, whereas in the latter the flowers are always borne on spreading pedicels. Examples of plants that are intermediate between the two extremes are the following: *Ducloux* 2636 (P), *Ducloux* 1060 (E), *Ducloux* 240 (UC), *Maire* 2365 (E, K, UC), *Maire in October 1913* (P), *Maire* 295/1914 (BM).

*Circaea alpina* subsp. *angustifolia* is apparently endemic in Yunnan, China,

and is puzzling in that it shows no clear connection to any of the other subspecies of *C. alpina*, even though it combines the characteristics of several. In the position of the flowers it resembles *C. alpina* subsp. *caulescens* and is primitive in that respect and in having retained the minute bracteole at the base of the pedicels. Vegetatively it is advanced in having very narrow leaves with cuneate bases and in having purple pigment in the unciniate hairs of the fruit. It seems most likely that *C. alpina* subsp. *angustifolia* arose early in the evolution of the *Circaea alpina* complex and has evolved independently of the other subspecies. Another possibility is that the position of the flowers at anthesis is a secondarily derived condition and that subsp. *angustifolia* could have evolved from ancestral plants similar to *C. alpina* subsp. *imaicola*.

**7c. *Circaea alpina* L. subsp. *imaicola* (Asch. & Magnus) Kitamura, Fl. Afghanistan 279. 1960.—FIG. 20.**

*Circaea alpina* L. var. *imaicola* Asch. & Magnus, Bot. Zeitung (Berlin). 28: 749. 1870.

*Circaea pricei* Hayata, Ic. Pl. Formosa 5: 72. 1915. TYPE: China, Taiwan, A-li-shan ("Taltaka, Hori-sha"), 1,800 m, 9 July 1912, W. R. Price 810 (TI, lectotype; K, 2 sheets, probable isolectotypes).

*Circaea imaicola* (Asch. & Magnus) Hand.-Mazz., Symb. Sin. 7: 603. 1933.

*Circaea minutula* Ohwi, Acta Phytotax. & Geobot. 2: 151. 1933. TYPE: China, Taiwan, Tai-chung Hsien, Hattsukan, 9 July 1933, J. Ohwi 3868 (KYO, holotype; TI, isotype).

*Circaea taiwaniana* S. S. Ying, Alpine Pl. Taiwan in Color 2: 199. 1978. This is most likely *C. alpina* L. subsp. *imaicola* (Asch. & Magnus) Kitamura. TYPE: China, Taiwan, Maboulashesan, alt. 3,100 m, S. S. Ying 2751 (deposition of type not given and type not seen).

Plants (0.35–)0.7–3(–4.5) dm tall. Stem densely to sparsely pubescent with short, soft, falcately recurved hairs 0.1–0.2 mm long, rarely subglabrous; the petiole with similar but upwardly curved hairs; the leaves, at least along the veins above, also with similar hairs and also sometimes with longer strigillose hairs to 0.4 mm long; the inflorescence densely to sparsely pubescent with short, soft, capitate and clavate-tipped, glandular hairs or with hairs as on the stem, or an admixture of the two. The stem, and less so the petiole, firm, terete, remaining unflattened in pressing, or occasionally the petioles flattened and appearing slightly winged. Stem green or occasionally the nodes purple. Leaves deep green or bluish green, opaque; those between the middle and the summit of the stem the largest, 2–5(–7) cm long, 1.4–3.2(–4.5) cm wide; becoming gradually to abruptly reduced upward to the base of the inflorescence and ultimately bractlike, gradually to abruptly reduced downward; the leaves very rarely clustered near the summit of the stem and appearing whorled. Leaves ovate to broadly ovate, less commonly orbicular ovate, acute to very short acuminate at the apex, broadly cuneate to subcordate, but most commonly truncate or rounded at the base, subentire to occasionally prominently dentate, the apex of the teeth usually blunt; pubescent, rarely glabrous, with short, soft, falcate hairs 0.1–0.2 mm long, at least on the veins above, and sometimes also beneath, occasionally also with longer, 0.2–0.4 mm long, strigillose hairs intermixed, also with straight to falcate cilia along the margins. Petiole 0.7–3(–3.5) cm long, terete or subterete, pubescent, rarely glabrous, with soft, short, upwardly curved, falcate hairs 0.1–0.2 mm long; with or without reduced branches arising in the axils. Inflorescence pubescent, less commonly glabrous, with short, soft, capitate or clavate-tipped, glandular hairs 0.1–0.2 mm long or with hairs as on the stem or with an admixture of



the two, terminal on the main stem and upper axillary branches, very rarely at the tips of axillary branches arising from the base of the stem. The inflorescence simple or, most commonly, with alternate or occasionally opposite lateral racemes from the base, these subtended by reduced leaves or leaflike bracts. Flowering pedicels glabrous, 0.6–2.5 mm long, erect or ascending; the flowers opening before elongation of the raceme and clustered at the apex; with a minute setaceous bracteole, 0.2–0.4 mm long, at the base. Fruiting pedicels 2.5–4(–5) mm long. Buds glabrous or rarely glabrescent, oblong to oblong-obovate to very broadly obovate in outline, obtuse or, less commonly, minutely mammiform at the apex; from the summit of the ovary 1–1.2 mm long, 0.6–0.8(–1) mm thick, white or pink or sometimes pink tinged only at the apex. Ovary 0.9–1.3 mm long, 0.3–0.6 mm thick, clavate; pubescent, with soft, short, translucent, uncinuate hairs or occasionally glabrous. Floral tube from a mere constriction to 0.3 mm long, 0.2 mm thick at the narrowest point, funnelform to broadly so. Sepals (0.7–)0.9–1.6 mm long, 0.8–1.1 mm wide, white or pink or pink tinged only at the apex, oblong to ovate, rounded to the obtuse apex. Petals 0.5–1.8 mm long, 0.7–1.5 mm wide, longer than wide, white or pink, narrowly to broadly obovate in outline, the apical notch 0.2–0.5(–0.7) mm deep,  $\frac{1}{4}$ – $\frac{1}{2}$  the length of the petal; the petal lobes rounded. Filaments (0.4–)0.8–1.6 mm long; anthers ca. 0.2 mm long, ca. 0.2 mm thick. Style (0.5–)0.8–1.8 mm long, stigma 0.2–0.3 mm tall, 0.2–0.5 mm thick. Mature fruit clavate, 2.1–2.5 mm long, 0.5–1.1 mm thick, the translucent uncinuate hairs 0.3–0.5 mm long. Combined length of pedicel and mature fruit 4–6(–7) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: India, eastern peninsula, *Wight 989* (K, lectotype; G, GH, GOET, L, LE, not seen, S, W, isolectotypes).

Distribution (Fig. 19): Cool, moist places along streams, in thickets, in deciduous and coniferous forests in mountainous areas. Central and southwestern China, northwestern Vietnam, northeastern and northwestern Burma and Assam, India, westward along the south face of the Himalayas to northeastern Afghanistan; disjunct in Taiwan and in the mountains of southern India. From 1,500 to 2,300 m in southern India, 2,000 to 4,000 m elsewhere. Flowers, July to mid-September, sporadically to mid-October.

#### Specimens examined:

AFGHANISTAN. Nuristan, Chatrass, *S. Kitamura in 1955* (KYO).

BANGLADESH. "E Bengal," *Griffith 2231* (GH, L, S, W).

BHUTAN. *F. Ludlow & Sherriff s.n.* (BM); near Bumthang, *F. Ludlow et al. 16978* (BM, E, G, UPS); Bumthang, *F. Ludlow et al. 19529* (BM, E, UPS); Rudd La, W side, *F. Ludlow et al. 20969* (E, UPS).

BURMA. Naung Chaung valley, *F. Kingdon-Ward in 1914* (E); Mindat, *F. Kingdon-Ward 22628* (BM); S Shan State, Kuy Tung, *R. W. MacGregor 796* (E).

CHINA. ANHUI: Mt. Huangshan, *R. C. Ching 8617* (ND, US), 8623 (ND, US), 61857 (NAS), *K. C. Kuan 75279* (PE), *P. C. Tsoong 3714* (PE). FUJIAN: Wuyi Shan, *C. P. Tsien 400618* (PE). GANSU: Yuzhong Hsien, *Hwanghe Exped. 3228, 3505* (PE); Lapuleng, *K. T. Fu 1227, 1648* (PE); Tetung, *Przewalsky 694* (P); Lapuleng, *T. P. Wang 5792* (PE); Min Hsien, *T. P. Wang 4646* (PE); Jiangyuan Hsien, Lung-te-kou, *T. P. Wang 17050* (PE). HENAN: Lushi Hsien, Lao-chun-shan, *K. M. Liou 5130, 5217* (PE); Song Hsien, *H. M. Shih 34939* (PE). HUBEI: Shennongjia, *Z. S. Chang & K. S. Fu 1008* (NAS, PE); S Badong ("Patung"), *A. Henry 6086* (GH, K, NY); Fang, also Hsing-shan, *A. Henry*

6906 (BM, K, NY); Shennongjia, *Shennongjia Exped. 21964, 31749, 32361* (PE). JIANGXI: Lu Shan, *M. J. Wang 826* (NAS). QINGHAI: Datong Hsien, *K. M. Liou 5959* (PE); Tongren Hsien, *T. P. Wang 6177* (PE). SHANXI: Ningwu Hsien, *Shanxi Exped. 1618* (PE). SHAANXI: Huanglong Shan, *K. T. Fu 3355* (PE); Taipaishan, *P. C. Tsoong 2511* (PE). SICHUAN: Baoxing Hsien, *X. S. Chang 7210* (PE); Jinchuan Hsien, *X. S. Chang 7210* (PE); Miyi, *S. Y. Chen et al. 10903, 11056, 11181* (NAS); Tienchuan, K'ang-ting, Hsi-k'ang, *H. L. Chiang 265937* (PE); Tsio-ha-ping, Konting trip, *C. Y. Chiao 2072* (A); Ebian, *T. S. Choa s.n.* (NAS); Eshan, *T. Y. Chou & K. C. Hsu 472* (NAS); Emei Shan, *T. Y. Chou & K. C. Hsu 482* (NAS); Baoxing Hsien, *K. L. Chü 3242, 3381, 3476* (PE); Fuxiong Hsien, *Econ. Pl. Exped. 4501, 4510* (PE); Dawi Hsien, *Exped. Pl. Med. Sichuan 15376, 15728* (NAS); Zolge, *Exped. Pl. Med. Sichuan 20383* (NAS); Tchen-keou-tin, *R. P. Farges s.n.* (P); N of Yungning, Muli Monastery, *F. Handel-Mazzetti 7358* (US, W); "Szechwan," *A. Henry 8950* (K); Mao Hsien, *C. Ho & T. L. Chow 14003* (NAS); Li Hsien, *C. Ho & T. L. Chow 13284, 14003* (PE); Emei Shan, *Y. Y. Ho 6286* (NAS); Tainig Hsien, *W. G. Hu 10925* (PE); Dawu Hsien, *W. G. Hu & C. Ho 10964, 11026* (PE); Tianquan Hsien, *X. L. Jiang 35594, 38023* (PE); Heishui Hsien, *X. L. Jiang 73397, 77080* (PE); Dajin Hsien, *X. L. Jiang 78236* (PE); Aba Hsien, *H. Li 74080* (NAS); Heishui Hsien, *H. Li 74080* (NAS, PE); Daijin, *H. Li 78705* (NAS); Jinfo Shan, *K. F. Li 63026* (PE); Kangding Hsien, *C. S. Liu 1140* (PE); Kangding ("Tachienlu"), *A. E. Pratt 436* (BM, K, P), *590* (BM, K), *650* (P); Drogochi, *H. Smith 4715* (UPS); K'ang-ting, Cheto-la, *H. Smith 10948* (S, UPS); "Tibet oriental," *J. A. Soulie in 1895* (K, NY); Tung-o-lo, Kiala, *J. A. Soulie 364* (G); Kangding ("Ta-Tsien-lou"), *J. A. Soulie 364* (P), *2347* (P); Mt. Emei Shan, Chi-tien-chiao, *S. C. Sun & K. Chang 1085* (A); Nanping Shi, *Y. C. Tang et al. 104* (PE); Dege, *Y. W. Tsui 5111a, 5126* (PE); Chi-na-tung, Tsa-wa-rung, *C. W. Wang in 1935* (TAI), *65191, 65232* (A); Emei Shan, *F. T. Wang 23310* (PE), *23395* (GH, LE, PE); "W Szechwan," *E. H. Wilson 4462, 5167* (A); Barkam, *C. L. Wu 32728* (PE); Li Hsien, *C. L. Wu 33498* (PE); Shimian Hsien, *C. S. Xie 41972* (PE); Jinchuan Hsien, *J. M. Xue 15* (PE); Weixi Hsien, *K. H. Yang 58887* (PE). TAIWAN: Hualien Hsien, Mt. Hohuan Shan, *D. E. Boufford et al. 19320* (CM, K, KYO, MHA, MO, NCU); Hualien Hsien, Ta-yu-ling, *C. Chuang & M. Kao 4430* (NY); Chiayi Hsien, Ta-ta-chi to Pai-yunn Hostel, *C. C. Hsu 6259* (TAI, TI); Taichung Hsien, Chika to 369, *T. C. Huang & C. F. Hsieh 7164* (TAI); Chiayi Hsien, Mt. Yu-shan, *R. Kanehira & S. Sasaki in 1927* (TAI); Nantou Hsien, between Ten-tsu & Yin-hai, *M. T. Kao 5861* (TAI), *T. C. Huang et al. 5859* (TAI); Chiayi Hsien, Mt. Yu-shan ("Mt. Morrison"), *T. Kawakami 2030* (TAI); Taipei Hsien? ("Prov. Taipei"), upper Tai-ko-ke R., *K. Kojima & T. Shioma 2033* (KYO); Chiayi Hsien, Mt. Yu-shan, from Haiunsanso to Ton-pu, *H. Koyama 23957* (E, SHIN, TNS); Nantou Hsien, Neng-kao-shan ("Noko-zan"), *E. Matuda 255* (TI); Nantou Hsien, Yu-shan, *A. Ohno 1701* (KANA); Ilan Hsien, Mt. Nan-hu-ta-shan ("Nankotai-san"), *J. Ohwi 3938* (KYO); Tainan Hsien, Ali-shan ("Tataka"), *W. R. Price 810* (K); Ilan Hsien, Mt. Nan-hu-ta-shan, *S. Sasaki in 1923* (TAI); Ilan Hsien, Lo-tung, *S. Sasaki in 1928* (TAIF); Hsinchu Hsien, Mt. Ta-pa-chien-shan, *T. Shimizu 20264* (SHIN); Hualien Hsien, *T. Suzuki 15041* (PE); Tainan Hsien, between Numanohira & Ali-shan ("Tataka"), *M. Tagawa 320* (KYO, TNS); Ilan Hsien, Mt. Nan-hu-ta-shan, between Kamibajin & Kirettoi, *M. Tamura et al. 20880* (SHIN); Ilan Hsien, Mt. Nan-hu-ta-shan, between Kirettoi & Kamibajin, *M. Tamura et al. 20988* (KYO, SHIN, TI); Nantou Hsien, from Tung-pu to Patungkuan, *M. Tamura et al. 22016* (SHIN); Nantou Hsien, Mt. Yu-shan, from Patungkuan to summit, *M. Tamura et al. 22085* (SHIN); Chiayi Hsien, en route from Tataka to Ali-shan, *M. Tamura et al. 22223* (SHIN); Nantou Hsien, Mt. Neng-kao-shan, between Tien-chih & Yun-hai, *M. Tamura & H. Koyama 23406* (KYO, S, TNS); Ilan Hsien, Nan-hu-ta-shan, Kietei-Bunakkei, *T. Yamazaki et al. 316* (TAI, TI); Ilan Hsien, Nan-hu-ta-shan, *T. Yamazaki et al. 385* (TI); Chiayi Hsien, Ali-shan, Paiyunshan-chuang, *T. Yamazaki & F. Yamazaki 790* (TI); Hualien Hsien, Mt. Hohuan-shan, *S. Ying 1289, 4882* (NTUF); Chiayi Hsien, Mt. Yu-shan, *S. Ying 1461* (NTUF); Ilan Hsien, Mt. Nan-hu-ta-shan, *S. Ying 2081* (NTUF); Hsinchu Hsien, Ta-pa-chien-shan, *S. Ying 4217, 4219, 4221, 4225* (NTUF). XIZANG (Tibet): Bomi Hsien, *Y. T. Chang & K. Y. Lang 449* (PE); Zhamo, *Y. T. Chang & K. Y. Lang 610* (PE); Nyingchi Hsien, *Y. T. Chang & K. Y. Lang 1333* (PE); Milin Hsien, *Kokonor-Tibet Exped. 74-1941* (PE); Gyala, *F. Ludlow et al. 5353* (BM, E, UPS); Kongbo Prov., Kulu Phu Chu, *F. Ludlow et al. 5947* (BM, E); Kongbo Prov., Nyoto Sama, *F. Ludlow et al. 15583* (BM, E, UPS); Zayu, *Qinghai-Xizang Exped. 731016* (PE); Medog, *Qinghai-Xizang Exped. 743977* (PE); Mainling Hsien, *Qinghai-Xizang Exped. 3908, 4097, 741941, 750876, 750878* (PE); Bienpa Hsien, *D. D. Tao 11203* (PE); Najia Hsien, *P. C. Tsoong 6718* (PE); Tsawarung, *C. W. Wang 65191, 65232* (PE); Yigong Hsien, *J. S. Ying & T. Y. Hong 542* (PE); Bomi Hsien, *J. S. Ying & T. Y. Hong 925* (PE). YUNNAN: Kunming ("Yunnan-fu"), *J. Cavalerie in 1919* (S, UPS); Likiang, *A. L. Chang & S. W. Yu 100982* (KUN); Fumin Hsien, *B. Y. Chiu 596142* (PE); Kunming, *B. Y. Chiu 771291* (KUN); Chungtien, *Chungtien Exped. 847, 1027, 1297* (PE); Mao-kon-tchang, *J. Delavay 54* (MO, P); Chiao-ch'e-tong, Hei-shan, *J. Delavay in 1885* (P); Hoking, Kona-lu-po, *J. Delavay 117, 119* (P); Ma-eul-shan, *J. Delavay 3856* (P); Yo-lin-shan, *J. Delavay 6533* (MO, P); Tse-tsa-long, *J. Delavay 6630* (US); Liang-shan ("Leang-ouang-shan"), *J. Delavay 6907* (P); Lung-i ("Lang-nyg tsin"), *F. Ducloux 2636* (P, US); Wuding Hsien, *Exped. Pl. Trop. Yunnan 60-141* (NAS); SE Chung-tien, between Anangu & Bodo, *K. M. Feng 2048* (A); Li-

chiang Range, E flank, *G. Forrest* 2922 (E); Tali Range, E flank, *G. Forrest* 4748 (BM, E, P); Li-chiang Range, E flank, *G. Forrest* 6332 (BM, E), W flank, *G. Forrest* 6338 (BM, E, P); Mekong-Salween divide, *G. Forrest* 19644 (E, UC, US, W); Li-chiang Range, *G. Forrest* 22399 (E, UC, US, W); N of Lichiang, to Yungning, *F. Handel-Mazzetti* 7029 (E, LE, W); Jingdong, *K. H. Hsue* 5415 (NAS); Kunming, *T. N. Liou* 17102 (PE); Yunnan Hsien, *E. E. Maire* 203 (E); Tong-chouan, *E. E. Maire* 7683 (NY, UC, US); between Kunming ("Yunnan-fu") & I-pin ("Suifu"), *R. Mell* in 1914 (W); Tse-kou, *Monbeig s.n.* (E, NY, P, US); vicinity of Lichiang, *C. Schneider* 3232 (G, GH, US); Kunming ("Yunnan-fu"), *O. Schoch* 306 (US); Lan-ping Hsien, *H. T. Tsai* 54053 (NAS); Lenping Hsien, *H. T. Tsai* 54012 (A, PE), 54083 (A, PE); Chi-tye-lo Hsien, *H. T. Tsai* 58180 (NAS); Chongshan, Tali, *Y. Tsiang* 11572 (NAS); Wei-hsi Hsien, Yeh-chih, *C. W. Wang* 68166, 62271 (A); Weisi Hsien, *C. W. Wang* 64568 (PE), 67667 (A, PE), 67687 (PE), 67969 (A, PE), 68679 (A, NAS, PE), 68271 (PE), 68369 (A, PE), 68679 (NAS, PE); Chinatung, *C. W. Wang* 65191 (NAS); Gongshan Hsien, *C. W. Wang* 67210 (PE); Deqem Hsien, *C. W. Wang* 67667, 68166, 68863 (PE), 69214, 69864 (A, PE); Huann-fu-ping, A-tun-tze, *C. W. Wang* 69214 (NAS); Chen-k'ang, Snow Range, *T. T. Yü* 17045 (A, E); Chiang-ch'uan, Buhlaka (Chulung), *T. T. Yü* 19582 (A, E); Likiang, *S. W. Yu* 64-045 (KUN); Zhongdian, *Zhongdian Exped.* 849 (PE). ZHEJIANG: Taihua Shan, *K. K. Tsoong* 2213 (PE).

INDIA. ASSAM: Khasi Hills, Mawphlang, *R. Chand* 2274 (MICH), 7978 (DS, MICH); Khasi Hills, Tsillong, *C. B. Clarke* 5815 (BM); Shillong, *C. B. Clarke* 38753 (G); Naga Hills, Kohina, *C. B. Clarke* 40987 (BM); Khasi Hills, *J. D. Hooker & T. Thomson s.n.* (BM, G, L, LD, S, UPS, W); Khasi Hills, Shillong, *F. Kingdon-Ward* 18675 (A, BM); Khasi Hills, Laitlynkot, *W. Koelz* 23114 (DS, MICH), 23328 (DS, MICH); Khasi Hills, Mawryngkneng, *W. Koelz* 28318 (DS, MICH). WEST BENGAL: Darjeeling, Phalut, *H. Hara et al.* in 1960 (TI); Darjeeling, Sandakphu, *A. K. Skvortsov* in 1972 (MO). HIMACHAL PRADESH: Manali, *U. C. Bhattacharyya* 44746 (TI); Dalhousie, *C. B. Clarke* 22381 (BM); Simla, *J. Drummond* in 1884 (G); between Dalhousie & Chamba, *J. Duthie* 18038 (UC, W); Mahasu, *Fleming* in 1849 (E); Simla, *Harmand s.n.* (P); Chamba, *J. H. Lace* 1855 (E); Simla, *R. N. Parker* 3357 (GH); above Simla, *L. Ram* 1585 (E); Kotgarh, *Stoliczka s.n.* (W); Simla, *G. Watt* in 1887 (E); Jalanri Pass, near Simla, *G. Watt* 9614 (E). KERALA: Kottayam Dist., Petimudi-Devicolam, *B. V. Shetty* 26584 (MH). MADRAS: Palni Hills, *R. H. Beddome* 3145, 8226 (BM); Anamalai, *R. H. Beddome* 8227 (BM); Madurai Dist., Vattakanal, *D. B. Deb* 30968 (MH); Nilgiri Dist., Tamilnadu, Mukurti, *J. Ellis* 43413 (MH); Palni Hills, *M. A. Evershed s.n.* (BM); Nilgiri Hills, *M. Perrottet* in 1837-1838 (G); Nilgiris, *R. J. Shuttleworth s.n.* (BM); Nilgiri Mts. & Kurg, *G. T. s.n.* (GH, L, P, W); Nilgiri Hills, *M. Wight* in 1841 (E), *M. Wight* 94 (G). MANIPUR: Ukhrul, *F. Kingdon-Ward* 17976 (BM, NY). PUNJAB: Hathu above Simla, *J. Drummond* 1586 (UC); Kunawar, *J. Drummond* 22331 (UC). WEST PUNJAB: Kulu, Nandukital, *W. Koelz* 1442 (MICH, NY); Dalhousie, *W. Koelz* 8879 (NA, NY). SIKKIM: Lachung, *G. A. Gammie* 670 (E); Reg. temp., 9-12,000 ft., *J. D. Hooker s.n.* (GH, S); Lachung, *Rhibu & Rhomoo* 5567 (E). UTTAR PRADESH: Mussooree, Jabberkhet, *A. Anderson* in 1920 (E); Pindar Valley, Garwhal, *G. E. Bentham* in 1924 (BM); Tihri, Garhwal, Lekhun Gidh, Sri Kanta Mt., *J. F. Duthie* 1049 (G), 1049a (E, G); Chakrata, *B. Kaur* in 1958 (G); Kandia, Tehri, *W. Koelz* 21719 (NA, NY); Chakrata, Chilmiri-Neck, *K. Maheshwari* in 1958 (E); Deoband-Kanasar Road, Jaunsar, *M. B. Raizada* 7181 (DS, E); Jabberkhet, Mussooree, *R. R. Stewart* 11199 (MO, NA, NY, PENN), 16742 (US); Kumaon, *R. Strachey & J. E. Winterbottom* 1 (GH); Kumaon, Saba, *R. Strachey & J. E. Winterbottom* 2 (BM, GH); Kumaon, Binjar, *R. Strachey & J. E. Winterbottom* 3 (BM, GH). STATE UNKNOWN: Chimili Valley, *A. Anderson?* 1198 (E); Chandanwari, *H. Heybroek* 53 (L); Bear Khola, Kodaikanal Hills, *K. C. Jacob* 16172 (MH); "India," *V. Jacquemont* 739, 2364 (P); Lachul, Kokhsar, *W. Koelz* 695 (MICH, NY); pass above Lubbie, *J. R. Reid?* in 1885 (E); Garkanda, *Stoliczka s.n.* (W); Himal. Bor. Occ., *T. Thomson s.n.* (BM, G, GH, GOET, L, LD, NY, P, W).

KASHMIR. Lahnarg, *J. H. Barbour* in 1922 (BM); Kunshwan, *C. B. Clarke* 29471 (BM); vicinity of Pahlgam, 27 mi. N of Islamabad, *F. G. Dickason* 763 (MICH); vicinity of Sonamarg on the Sind R., *F. G. Dickason* 764 (MICH); Astor Dist., above Doyen, *J. F. Duthie* 12474 (E); Liddar Valley, *J. F. Duthie* 13064 (BM, E); Pahlgam, *M. A. Evershed* in 1913 (BM); above Tarakbal, *W. Koelz* 9186 (NA, NY); Pahlgam, *N. C. Nair* in 1966 (NCU); Azad, above Chikar, *E. Nasir* 1027 (E); Khelanmarg, *O. Polunin* 56/145 (BM); Ferosopae Nullah?, *P. Purfold* 232 (BM); Huzzaffarabad, Deepa Valley Road, *M. Qaiser & A. Ghaffar* 5009 (KUH); Pahlgam, *A. K. Skvortsov* in 1972 (MO); Koraghal, N slope Rajdhangan Pass, *R. R. Stewart* in 1946 (W); Tragbol, *R. R. Stewart* 4827 (PH); Padar, upper Chenab, *R. R. Stewart* 3075 (NY); Keran, Kishen Ganga valley and road to Nanga Parbat via Gangbal Lakes, *R. R. & I. D. Stewart* 17604 (NY, UC, US); Astor Dist., Rupal Nullah, *R. R. Stewart* 22852 (NY).

NEPAL. Kalingchok, *Banerji Herb.* in 1964 (A); Sunderijal Reservoir, 8 mi. NE of Kathmandu, *D. D. Bhatt* 41 (UC); Sheopuri, N of Kathmandu, *C. Chuma* in 1970 (TI); Suli Gad, *Einarsson et al.* 3200 (BM); Bilbatay, Bhanjang, above Tutay, *H. Hara et al.* 6300557 (KYO, TI); Hati Sar-Mangal-

bare-Lam, Phokari-Minchin Dhap, *H. Hara et al.* 6300558 (BM, KYO, TI); Taplejung-Heydewa-Bunklung, *H. Hara et al.* 6300559 (TI); Singalila, Kalapokhari, Sandakphu, *H. Hara et al.* 69918 (TI); Phulchoki, S of Kathmandu, *H. Kanai* 424 (KYO, TI); Sim Rhanjang, *H. Kanai* 673313 (KYO, TI); Hilay Dhap, *H. Kanai & Malla* 674737 (TI); Dor-tute, *H. Kanai et al.* 872272 (TI); Mul Kharka, Chipu Danda, *Malla & H. Kanai* 673496 (TI); Tolo Gompa Kholo, *S. Nakao & J. H. E.* 195 (KYO); Maharigaon, *O. Polunin et al.* 168 (BM); Jumla, *O. Polunin et al.* 382 (E, G, UPS); Langtang, *O. Polunin* 1646 (BM); Chutta, SE of Jumla, *O. Polunin et al.* 4921 (BM, E, UPS); N of Taplejung, Thapabu Kholo, *J. D. A. Stainton* 1179 (BM); Gurjakhani, *J. D. A. Stainton et al.* 3564 (E, UPS); Chimgaon, N of Tukucha, Kali Gandaki, *J. D. A. Stainton et al.* 7831 (BM, E); Lete, S of Tukucha, Kali Gandak R., *J. D. A. Stainton et al.* 7873 (BM); Milke Bahnjyang, *L. H. J. Williams* 1097 (BM).

PAKISTAN. Chitral above Shagram, Kagan Hills, *L. Ali & F. Grohmann* 5995 (RAW, US); Abbottabad ("Hazara"), Hill Terr., between Chail Sar & Ganja Kandao, *B. L. Burt & M. A. Kazmi* 1240 (E); Abbottabad, Nilishang Terr., Khator to Sharkul, *B. L. Burt & M. A. Kazmi* 1328 (E); Kankoli, Kagan Hazara, *J. Duthie in 1899* (CAS); Kao Forest, *D. McVean in 1960* (E); Swat, Jaba, *E. Nasir* 3941 (RAW); Murree, *E. Nasir & Y. Siddig* 29162 (RAW); Islamabad, Changla Gali, Murree Hills, *Y. Nasir* 70 (MO); Hazara Dist., Thandiari, *Y. Nasir* 6154 (RAW); Swat Dist., Jabber, *M. Qaiser & A. Ghaffar* 4822 (KUH); Swat State, between Maina & Ilam Mt., *R. J. Rodin* 5466 (G, UC, US); Hazara Dist., Mohshpuri, *M. A. Siddigi & Y. Nasir* 5991 (RAW); Changla Gali, Murree Hills, *R. R. Stewart in 1949* (PH, US), 4103 (MO, NY); Swat State, Utrat, *R. R. Stewart & A. Rahman* 15153a (BM); to Bantara Gali, *R. R. Stewart & E. Nasir* 24089 (RAW).

VIETNAM. Tonkin, Cha Pa, *M. Petelot* 3065 (P, UC), 3065A (NTUF).

*Circaea alpina* subsp. *imaicola* is distinguished by the flowers being held on erect or ascending pedicels and opening before elongation of the raceme, the pubescent (at least sparsely) stem, deep green or bluish-green opaque leaves, and the ovate to very broadly ovate leaves with usually rounded or truncate bases. A minute bracteole is present at the base of the pedicel. Although the vast majority of plants have subentire to minutely denticulate, pubescent leaves, some have leaves approaching *C. alpina* subsp. *alpina* and *micrantha* in shape and tooting. *Circaea alpina* subsp. *alpina* always has glabrous stems and those of *C. alpina* subsp. *micrantha* are usually glabrous. Both of these subspecies also have thinner, translucent leaves and softer petioles that are flattened and often appear winged in pressed specimens. Numerous specimens of *C. alpina* subsp. *imaicola* have the ovaries glabrous at maturity. Among these are *Monbeig*, Tsé-kou (E, NY, P), *Smith* 10948 (S, UPS), *Forrest* 6332 (BM, E), *Forrest* 6338 (BM, E, P), *Tsai* 54012, 54083 (A), *Delavay* 6533 (MO, P), plus many others. The collections of *Ludlow*, *Sherriff* and *Elliot* 15583 (BM, E) have prominently toothed leaves as in *C. alpina* subsp. *micrantha* but are noncordate as in subsp. *imaicola* and the flowers and stem pubescence are like subsp. *imaicola*. *Wang* 69079 (A) has lightly pubescent stems, glabrous ovaries at anthesis, a densely glandular inflorescence axis, prominently toothed leaves that are cordate at the base, but petals notched more than one fifth of the way to the base and represent plants intermediate between *C. alpina* subsp. *imaicola* and *micrantha*. These plants appear to be fully fertile, having normal fruit set.

In general, *Circaea alpina* subsp. *imaicola* grows at lower elevations than subsp. *micrantha* (Skortsov, 1977) but there is a considerable area of overlap between 3,000 and 4,000 meters. Plants of *C. alpina* subsp. *imaicola* often, but not always, tend to resemble subsp. *micrantha* to a greater degree as elevation increases.

**7d. *Circaea alpina* L. subsp. *pacifica* (Asch. & Magnus) Raven, in Calder & Taylor, *Canad. J. Bot.* 43: 1396. 1965.—FIG. 22.**

*Circaea pacifica* Asch. & Magnus, Bot. Zeitung (Berlin). 29: 392. 1871.

*Circaea alpina* L. var. *pacifica* (Asch. & Magnus) M. E. Jones, Bull. Univ. Mont. Biol. ser. 61: 39. 1910.

*Circaea alpina* L. forma *pacifica* (Asch. & Magnus) G. N. Jones, Univ. Wash. Publ. Biol. 5: 195. 1936.

Plants (1.0–)1.5–3.5(–5) dm tall. Stem densely to very sparsely pubescent, at least on the uppermost internodes or at the nodal areas, with soft, short, falcately recurved hairs, 0.1–0.2 mm long; the petiole glabrous to densely pubescent with hairs as on the stem but upwardly curved; the leaves glabrous or with similar, upwardly curved hairs along the veins, rarely on the interveinal areas near the base, on the upper surface; the inflorescence densely to sparsely pubescent with short glandular hairs. The stem, and less often the petioles, firm terete, remaining mostly unflattened in pressing, or the petioles flattened, and appearing winged. Stem green, very rarely the nodes purple. Leaves pale green, translucent; those near the summit of the stem, and most often the second pair below the inflorescence, the largest, 3–7.5(–11) cm long, 2–5.5(–8) cm wide; abruptly reduced upward and rapidly becoming bractlike at the base of the inflorescence, gradually or, rarely, abruptly reduced downward, only rarely a few pairs of leaves near the summit of the stem clustered and appearing somewhat whorled. Leaves ovate to broadly so, rarely subcircular, acute to very short acuminate at the apex, rounded to subcordate, very rarely cordate, at the base, subentire to denticulate; glabrous or with sparse, falcate hairs, 0.1–0.2 mm long on the main veins above and, less commonly, on the interveinal areas near the base, also with slightly curved to falcate cilia along the margins. Petiole 1.5–3(–5) cm long, subterete to terete, glabrous to densely pubescent, at least in lines along the upper surface, with short, soft, upwardly curved, falcate hairs, 0.1–0.2 mm long; with or without reduced branches arising in the axils. Inflorescence sparsely to, more commonly, densely pubescent with short, soft, capitate and clavate-tipped glandular hairs 0.1–0.2 mm long; terminal on the main stem and at the tips of the uppermost axillary branches, very rarely at the tips of axillary branches arising from the base of the stem in some dwarfed individuals. The inflorescence simple or, more commonly, with alternate or opposite lateral racemes from the base, these subtended by leaflike bracts, less commonly by reduced leaves. Flowering pedicels glabrous, 0.9–2.3 mm long, ascending or erect; the flowers clustered at the apex and opening before elongation of the raceme; with or without a minute bracteole at the base, when present, to 0.2 mm long. Fruiting pedicels (1.8–)2.3–4.2(–5) mm long. Buds glabrous, broadly elliptic to oblong obovate or narrowly to broadly obovate in outline, obtuse or minutely mammiform at the apex; from the summit of the ovary 1.5–2.2(–2.6) mm long, 0.6–1 mm thick; white. Ovary 0.5–1.1 mm long, 0.3–0.6 mm thick at anthesis, clavate to slenderly so, pubescent with soft, short, translucent, uncinuate hairs. Floral tube 0.3–0.5(–0.6) mm long, 0.2–0.3 mm thick at the narrowest point, broadly funnelform. Sepals 1–1.7(–2.1) mm long, 0.6–1.1 mm wide, white, oblong ovate to oblong obovate, rounded to the obtuse or minutely mammiform apex. Petals (0.8–)1–1.6 mm long, 0.7–1.3 mm wide, longer than wide, white, obovate to obdeltoid in outline; the apical notch 0.2–0.5 mm deep,  $\frac{1}{4}$ – $\frac{1}{3}$  the length of the petal; the petal lobes rounded. Filaments 0.8–2 mm long; anthers 0.3–0.4 mm long, 0.2–0.3 mm thick. Style 1.3–2.2 mm long; stigma 0.1–0.2 mm tall, 0.3–0.4 mm thick. Mature fruit clavate, rounded at the

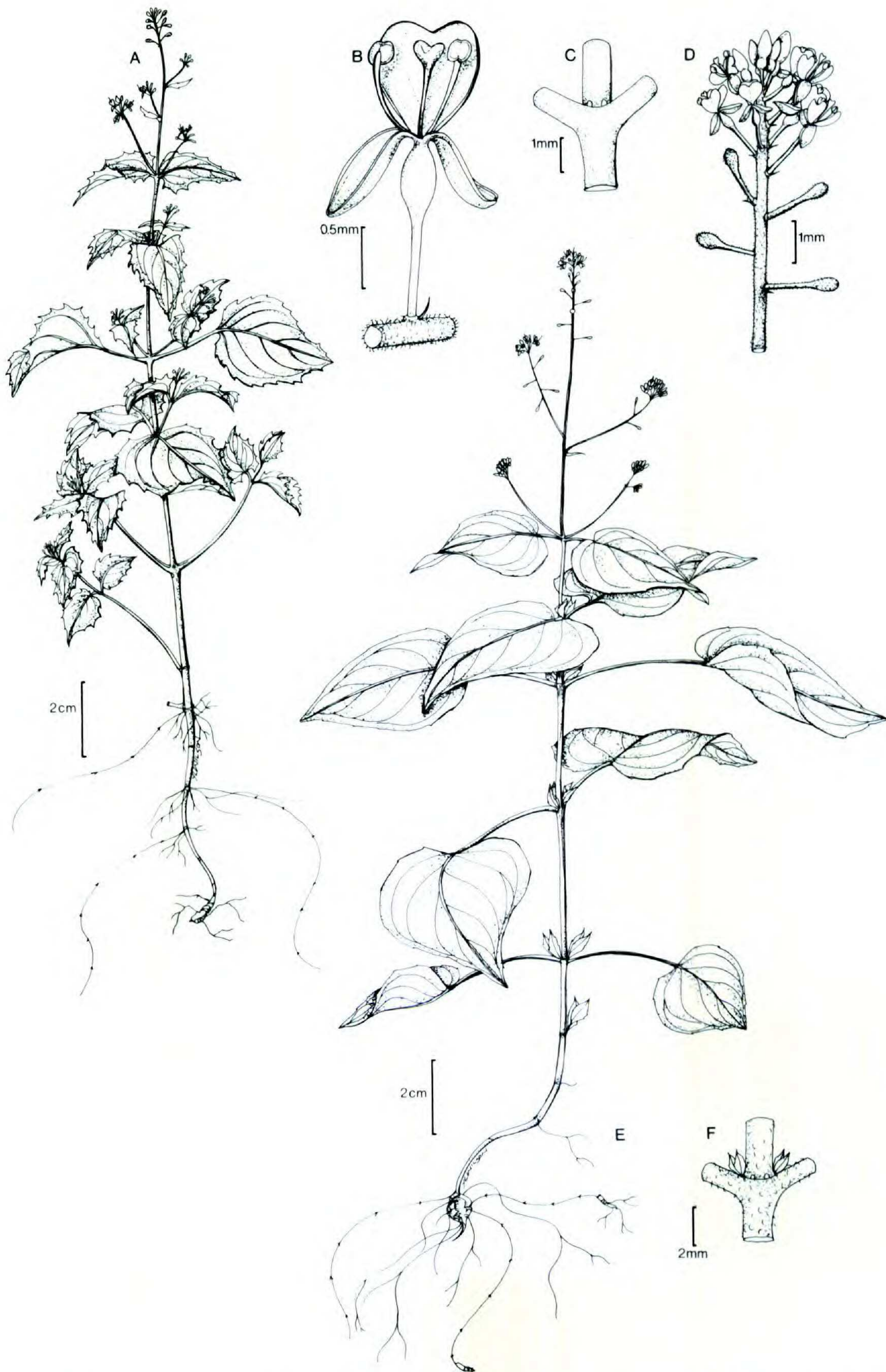


FIGURE 22. *Circaea alpina* L. subsp. *micrantha* (Skvortsov) Boufford.—A. Habit.—B. Flower with petal removed.—C. Node of stem.—D. Inflorescence. From Ludlow et al. 5106 (E). *Circaea alpina* L. subsp. *pacifica* (Asch. & Magnus) Raven.—E. Habit.—F. Node of stem. From Harris & Harris, *Pl. Exs. Grayanae* 672 (MO).

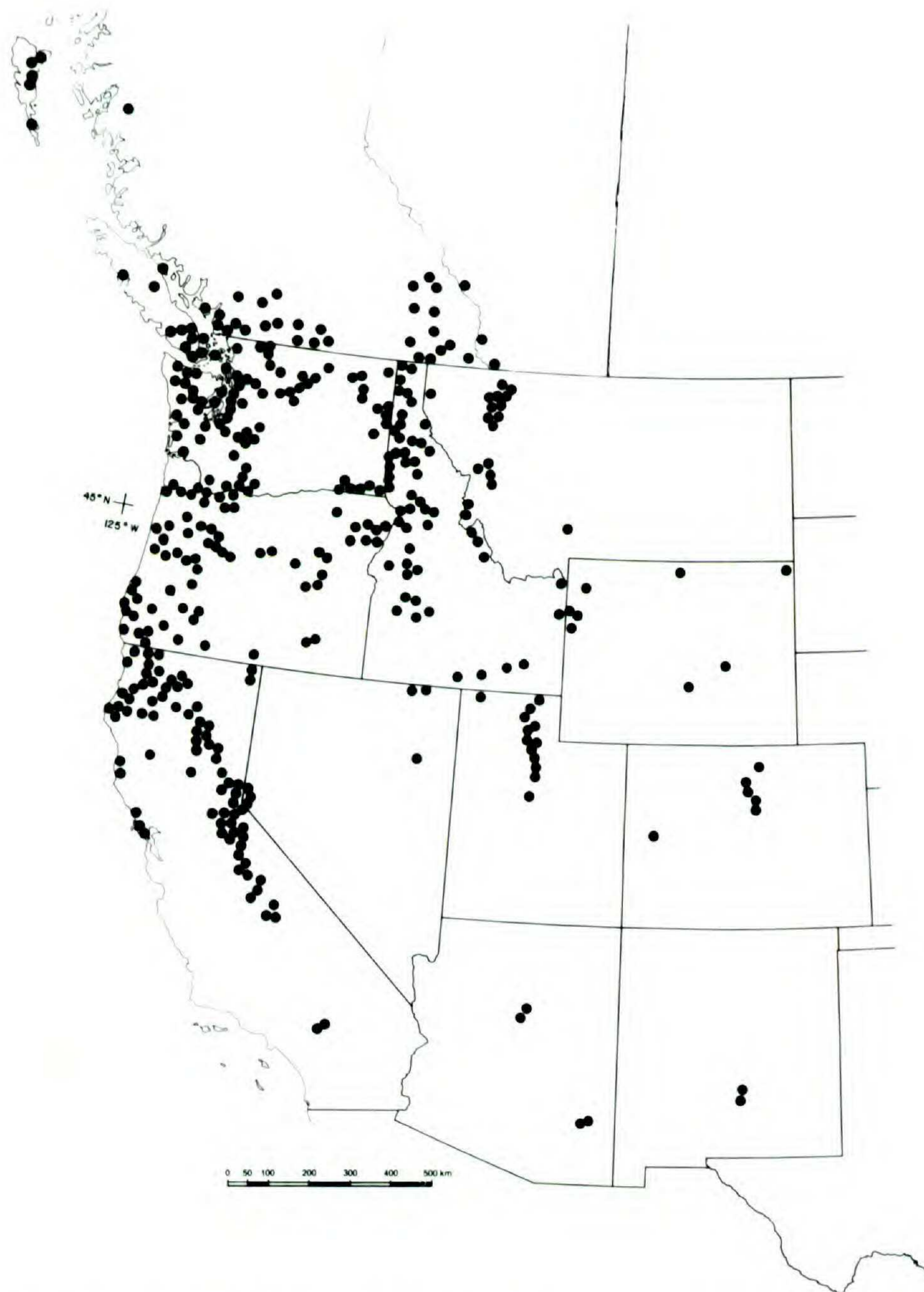


FIGURE 23. Distribution of *Circaea alpina* L. subsp. *pacifica* (Asch. & Magnus) Raven.

apex, 1.8–2.2(–2.5) mm long, 0.6–1.2 mm thick, the translucent uncinuate hairs 0.3–0.5 mm long. Combined length of pedicel and mature fruit (3.5–)4.2–5.5(–6.5) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: Munz (1965) gives as the type locality “Near San Francisco California.” This can probably be interpreted as a designation of Bolander’s collection, cited by Ascherson and Magnus (1871) in their original description, as the lectotype. However, I have been unable to locate any of Bolander’s specimens.

Distribution (Fig. 23): Cool moist coniferous forests. From the San Bernardino Mountains in southern California north to central British Columbia, eastward to the Rocky Mountains and southward in the mountains to New Mexico and Arizona. From near sea level, in the northwestern part of the range, to 2,700 m. Flowers, May to mid-August.

## Representative specimens examined:

CANADA. ALBERTA: Summit Lake, *G. Armstrong & J. Nagy 5033* (ALTA, CAN); Waterton Lakes National Park, Bertha Creek, *A. J. Breitung 17416* (ALTA, RSA, SMU); Waterton Lakes, trail to Bertha Lake, *A. J. Breitung 16214* (NY), *M. Malte & W. Watson 2624* (UAC, WTU), *R. T. Ogilvie in 1960* (UAC, UBC), *K. Shaw 2855* (BRY); Cameron Lake, *G. N. Jones 23915* (COLO, ILL), *J. Ewan 18496* (NO, RSA); Waterton Lake, *F. Hermann 13072* (ALTA, US); E slope of Mt. Crandell, *J. Kuijt & D. R. Dobbins 4434* (SMU); Crowsnest area, Upper Carbondale Valley, *R. T. Ogilvie in 1960* (UBC); Castle R. region, *R. Cormack in 1944* (ALTA); Castlemount, 8 mi. up W Branch of Castlemount R., *M. Malte & W. Watson 2505* (UAC); between N Kootenai Mt. and Lynx Creek Campground, *J. Parker & G. Silberhorn 1971-138* (ALTA). BRITISH COLUMBIA: Vancouver Island, Nanaimo District, Goldstream, *J. Anderson in 1908* (V, WS), *J. Anderson 152* (V), *J. W. Eastham in 1939* (UBC); Goldstream Provincial Park, *J. Bailey 7161* (V); Nanaimo, Discovery Bay, *A. Eastwood 9890* (CAS); Cowihan Lake, Robertson Creek, *J. Anderson in 1916* (V, WS); vicinity of Nanaimo, *J. Macoun in 1908* (CAN, NY); along the San Juan R. E of Port Renfrew, *J. A. Calder & K. T. Mackay 30922* (DAO, DS, MAK); W Nanaimo R. valley, *D. Mueller-Dombois 11-25* (UBC); head of Finlayson Arm, N of Victoria, *J. A. Calder & K. T. Mackay 31516* (DAO); Alberni, Roger Creek, *W. R. Carter C405* (POM, V); Loman R., *W. R. Carter 10H1* (UBC); Westholm, Eves Park, *N. Chapman 243* (V); Sooke Harbour, *G. Copley 350* (V); Cowichan Lake, near Shaw Creek, *S. Ewan & L. Pugsley 126* (V); Green Mt., *S. Ewan & G. Pugsley in 1973* (V); Strathcona Provincial Park, *S. Kojima in 1969* (UBC); Macmillan Park, 187 mi. N, *V. Krajina & R. H. Spilsbury 4879* (UBC); between 3rd & 4th Nanaimo Lakes, *V. Krajina et al. 5315* (UBC); Macmillan Park, *V. Krajina et al. 5340* (UBC); Saanich, *W. Newcombe 8830* (V); Sooke District, Coal Creek, *C. Newcombe in 1894* (V); Cowichan District, *W. Newton in 1929* (DAO); Kyuquot, Kaouk R., *T. M. C. Taylor & A. F. Szczawinski 314* (UBC, V); Saltspring Island, Mt. Tuam, *T. R. Ashlee in 1957* (UBC); Fraser River delta, Burns Bog, *K. I. Beamish 680155* (UBC); 9 mi. N of Squamish on Paradise Valley Road, *K. Beamish et al. 610191* (CAN, UBC); Kaslo, *M. Bell in 1960* (UBC); Flathead District, Calvin Creek, *M. Bell & J. Davidson 863* (DAO, UBC, V); Anvil Island, N side, *W. Bird 4088* (UBC); Hope, *T. C. Brayshaw 49207* (UBC); Quadra Island, from Heriot Bay to Granite Bay, *J. A. Calder & K. T. Mackay 30050* (DAO); 6 mi. SE of Nakusp, *J. A. Calder & D. Savile 9981* (DAO); N of W Creston, *J. A. Calder & D. Savile 9327* (DAO); 7.5 mi. SW of Cheam View on Hope-Vancouver Hwy, *J. A. Calder & D. Savile in 1953* (DAO); Graham Island, Yakoun R. bridge SW of Port Clements, *J. A. Calder & D. Savile 35560* (B, DAO, H, V, W); ca. 4.5 mi. S of Port Clements, *J. A. Calder et al. 35038* (DAO); Cultus Lake, *C. Carl 13756* (V); near Quamichan Lake, Duncan, *D. Charter 129* (UBC); Manning Park, Castle Creek, *C. C. Chuang 525* (CAN, UBC, V); Manning Park, Grainger Creek, *C. C. Chuang 1279* (V); Mayne Island, *J. Davidson in 1915* (UBC), *J. Macoun 238* (V); Whiterock, *J. Davidson in 1916* (UBC); Nelson, Ymir R., *J. W. Eastham in 1937* (UBC); Erickson, *J. W. Eastham in 1938* (DAO, UBC); W Langley, *J. C. Ellens in 1960* (NCU, V); ca. 2.5 mi. SW of Rosedale, *D. Faris, Jr. 94* (DAO, UBC, V); Hope-Princeton area, *F. Fodor in 1938-1945* (UBC); Salt Spring Island, Ganges, *V. Goddard in 1935* (V); 9 mi. NW of Oliver, *J. Grant 62-35* (DAO); Otter Road near Langley Prairie, *H. Groh s.n.* (DAO); Manning Park, *G. Hardy 21726* (V); Kamloops District, Celista, N side of Shuswap Lake, *G. Hardy in 1952* (V); near Vancouver, *J. K. Henry 4242* (RM); Kokanee Park, *B. Herbison WK73419A* (V); Borser Island, *A. Hill in 1897* (UBC); Spanish Banks, *L. Holm 405* (UBC); Shawnigan Lake, *F. Hunnewell 7835* (GH); Lytton, *V. J. Krajina in 1949* (NCU, UBC, WTU); Paradise Valley, *D. L. Krause 3067* (UBC); Griffin Island, *J. Macoun 677* (CAN, DAO, US); Rocky Mts., Cannore, *J. Macoun 2020* (CAN); Chilliwack R., *J. Macoun 44409* (CAN, WS); Columbia Valley, Donald, *J. Macoun in 1885* (MTMG, NY); 40 mi. E of Bella Coola, *T. T. McCabe 1531* (UC, WTU); Silver Creek, *T. T. McCabe 2474* (UC); Alta Lake, Sproat Mt., *T. T. McCabe 2984* (UC); Sumas Mt., Sumas Prairie by McKay Creek, *T. T. McCabe 3614* (UC); E side of Kootenay Lake, *W. McCalla 8325* (ALTA, V); Cheakamis R. Road, 1-2 mi. above Fergie's Lodge, *W. H. Parker 152* (DAO, UBC); 6 mi. NE of Rosedale, *H. Senn et al. 5824* (DAO); Salmo, *J. Shoustoff 44* (V); Glacier National Park, Cougar Valley, *A. F. Szczawinski in 1964* (UBC, V); near Moyie R., Tochty, *R. L. Taylor & D. H. Ferguson 2861* (DAO, DS); Galena, *T. M. C. Taylor & A. F. Szczawinski 526* (UBC); Victoria, *J. Tolmie in 1897* (DAO); Armstrong, Okanagan, *E. Wilson s.n.* (UBC); Selkirk Mts., N Fork Illecillewaet R., *J. MacMillan 564* (MO); Upper Loop Creek Valley, Glacier, *E. W. D. Holway in 1914* (MIN); Illecillewaet Valley, *S. Brown 660* (CAN, MO, PH, US); Queen Charlotte Islands, Graham Island, Mamin R. delta at Juskatla, *R. L. Taylor 133* (DAO); Honna R., Skidegate Inlet, *R. Pillsbury 357* (UBC); ca. 2 mi. W of Queen Charlotte City, *J. A. Calder et al. 34802* (DAO); Moresby Island, Copper Creek 3 mi. S of Copper Bay, *J. A. Calder et al. 21885* (DAO); Queen Charlotte City, near bridge over Honna R., *J. A. Calder & R. L. Taylor 36934* (B, COLO, DAO, DS, MAK, NCU, RSA, TUR, UC, WS, WTU); Mt. Cheam, *F. Anderson in 1899* (DAO).

UNITED STATES. ALASKA: Juneau, *E. Shumway in 1890* (GH). ARIZONA: COCONINO COUNTY, Oak Creek Canyon, Coconino National Forest, *D. Demaree 41261* (ASU), upper Oak Creek, *H. J.*



*Fulton 9673* (ARIZ); GRAHAM COUNTY, Graham Mts., Swift Trail Road, *B. Maguire 12121* (BRY, DAO, GH, RM, UC, UTC, WS, WTU), Mt. Graham, *R. Peebles et al. 4482* (NA, US), Wet Canyon Campground in Pinaleno Mts., *Moore, Pinkava & Lehto L6348* (ASU, NCU, OS, UNCC), *R. A. Darrow 1052* (ARIZ), *S. Bingham 1555* (ASU). CALIFORNIA: ALPINE COUNTY, near Douglas Station, *R. Hoover 2602* (UC), Stanislaus Forest, Iceberg Meadow Ranger Station, *W. W. Eggleston 9560* (US); AMADOR COUNTY, 2.5 mi. W of Blakely, *C. Belshaw 2416* (UC), Panther Creek, *G. Hansen 272* (DS, MO), Mokelumne R. and tributaries, Deer Creek, *G. Hansen 272* (NY), Tiger Creek, *G. Hansen 272* (US); BUTTE COUNTY, first summit, Oroville-Quincy, *L. Benson 3962* (ND, POM), Jonesville, *E. B. Copeland 386* (ARIZ, CAS, CU, DS, GH, H, MICH, MO, NY, ORE, RM, RSA, UC, US, W, WIS), neighborhood of Jonesville, *H. F. Copeland 428* (DS, OKLA, POM, WIS), Butte Meadows, *A. A. Heller 14687* (DS, MO, NY, US, WTU), 3 mi. SE of Butte Meadows, Paynes Creek, *P. Johannsen 942* (UC); CALAVERAS COUNTY, San Antonio Creek, *W. Dudley in 1906* (DS), 1.2 mi. NE of Dorrington Ranger Station, hwy 4, *P. C. Everett & E. K. Balls 22024* (NY, RM, RSA, WS), Big Trees, *J. Hawthorne & F. Blaisdell in 1899* (CAS), Snowden Ranch, near Calaveras Big Trees, *W. L. Jepson 14388* (JEPS), near Calaveras Grove of Big Trees, *W. McCalla 6215* (ALTA); DEL NORTE COUNTY, Requa and vicinity, *E. McGregor in 1921* (DS), Siskiyou Mts., Mill Creek, *L. R. Abrams 8469* (DS); ELDORADO COUNTY, Sly Park, *H. M. Hall 11295* (CAS), Lake Tahoe, Emerald Bay, top of Eagle Falls, *J. T. Howell 1272* (CAS), Pyramid Peak, *Brewer 2133* (UC), S Fork American R., *H. M. Hall & H. P. Chandler 4761* (CM, UC), Glen Alpine Canyon, *L. R. Abrams 12701* (DS, HG, MO, NA, NY, POM, UC, WTU), Cosumnes, *G. Hansen 1909* (NEB), from Fallen Leaf Lake to Lake of the Woods, *F. Peirson 6298* (RSA), S edge of Fallen Leaf Lake, *P. H. Raven 21436* (DS, RM, RSA, TEX), 3 mi. E of Camino, *G. Robbins 1141* (CAS, UC), near Lily Lake, *G. L. Smith 2300* (JEPS), Glen Alpine Spring, *G. L. Smith 3304* (JEPS), Camp Sacramento, *W. Vortried in 1925* (CAS), Lake Tahoe region, from Fallen Leaf Lake, *I. Wiggins 6770* (DS, ND), ca. 4 mi. N of U.S. hwy 50 junction on road to Emerald Bay, Lake Tahoe, *H. M. Wheeler 443* (JEPS, WTU); FRESNO COUNTY, Pine Ridge, *H. M. Hall & H. P. Chandler 214* (CM, DS, MIN, MO, NY, PH, UC, US), Huntington Lake, *A. Grant 1148* (CU, DS, JEPS), King's R., Sharp Creek near Cedar Grove Camp, *P. A. Munz 15917* (CAS, GH, MONTU, POM, UC, WTU), 1 mi. S of Kaiser Diggings, *C. H. Quibell 182* (RSA), Snake Camp, 2 mi. N of Shaver Lake, *C. H. Quibell 3838* (NCU, RSA), *C. H. Quibell 3942* (RSA), bank of Sheep Thief Creek, junction of Stump Springs Road and 168, *M. & H. Quibell 3544* (RSA), Daulton Road directly opposite Brown Cone, *C. H. Quibell 290* (RSA), Sequoia Mills, *A. Eastwood in 1893* (MIN), Horse Corral, *Mrs. J. Clemens in 1910* (POM), upper branch of Round Meadow, *E. Carter 5828* (RSA), Stump Springs Road, *L. Beane 1592* (DS); GLENN COUNTY, Plaskett Meadows, *J. T. Howell 19010* (BH, CAS); HUMBOLDT COUNTY, hwy 299 E of Blue Lake, *D. E. Anderson & J. P. Smith J-1101* (WS), Klamath R., *H. P. Chandler 1404* (CM, DS, GH, MIN, MO, NY, PH, RM, UC, US), 5 mi. W of Dyerville, *L. Constance 742* (WS), near Dinsmore's, *A. Eastwood & J. T. Howell 4780* (CAS), E of Bridgeville on hwy 36, *W. J. Ferlatte & B. D. Rogers 2095* (COLO, H, NLU, SMU, WIS, WTU, WVA), Yager Creek at 2,400 ft, *C. C. & S. K. Harris Pl. Exsic. Grayanae 672* (ARIZ, BH, BHO, CAN, CAS, COLO, CU, DAO, DS, DUKE, GA, GH, IA, ILL, IND, ISC, KANU, LL, MASS, MICH, MIN, MO, MONTU, NA, NCSC, NCU, NHA, NO, NY, OKLA, PAC, PENN, PH, POM, RM, SMU, TENN, TEX, TRTC, UC, UNCC, US, UTC, WIS, WS, WTU, WVA), Chapanal Mt., Bug Creek, *D. K. Kildale 3766* (BH), Lawrence Creek, *D. K. Kildale 835* (DS), Van Duzen, *A. R. & H. N. Moldenke 24876* (LL), 5 mi. N of Willow Creek on Racoon Creek, *P. A. Munz 16552* (OKLA, RSA, WTU), 1.1 mi. S of Friday Ridge Road on Titlow Hill Road, near Grouse Mt., *P. H. Raven & R. Snow 13640* (CAS, RSA), Yances Camp, *H. Smith 3909* (US), near Hydesville, Wolverton Gulch, *J. P. Tracy 2441* (UC), Lawrence Creek at crossing on the Kneeland Road, *J. P. Tracy 6691* (UC), Four Mile Creek on Friday Ridge Road, W of mouth of S Fork Trinity R., *J. P. Tracy 15381* (UC, TEX), valley of Van Duzen R. opposite Buck Mt., *J. P. Tracy 2716* (BRY, NCU, UC), along Willow Creek, near its mouth, *J. P. Tracy 3311* (UC, US), South Fork Mt., near McKay Camp, *J. P. Tracy 8927* (UC), ridges E of Corral Prairie, *J. P. Tracy 10585* (UC), Grouse Mt., *J. P. Tracy 13459* (DAO, UC), Trinity Summit, lower end of Butte Hole, *J. P. Tracy 14159* (UC, WIS), head of Little Hors-Linto Creek, *J. P. Tracy 15088* (UC, UTC), Bear R., 10 mi. upstream from mouth, *J. P. Tracy 15349* (UC), 5 mi. W of Dyerville, *L. N. & G. B. Upton in 1930* (CU), 11 mi. E of Hoopa Valley on new road to Trinity Summit, *C. Wolf 9253* (DS, MT, NY, RSA, TEX, WTU); LASSEN COUNTY, Mt. Lassen National Park, 1 mi. below Drakesbad, *B. Cain* (DS); MADERA COUNTY, Westfall Campground just S of Fish Camp & Mariposa County, *Cook et al. 2033* (ASU), Miami Ranger Station, *L. R. Gillogly 20* (ARIZ, ND, POM, UC); MARIN COUNTY, near Camp Taylor, *E. Cannon in 1899* (CAS), between Bolinas & Olema, *A. Eastwood in 1898* (MIN, RM, UC), between Lagunitas & Camp Taylor, Lagunitas Creek, *H. M. Hall 8503* (ARIZ, CAN, DS, GH, NY, ORE, OSC, POM, RM, UC, US, WTU), Devil's Gulch near Camp Taylor, *J. T. Howell 24324* (CAS), Paper Mill Creek, *W. L. Jepson 8279* (JEPS), Bear Valley, *E. Zeile in 1911* (CAS), canyon behind Inverness Park, *B. Schreiber 920* (UC), Taylorville, *J. Moore 384* (CAS), *A. Edwards in 1878* (NY), Mt. Tamalpais, Redwoods, *H. Reed 267* (NCSC, UC, UTC), Point Reyes, *H. M. Pollard in 1936* (B); MARIPOSA COUNTY, Yo-

semiter Valley, *E. F. Andrews in 1892* (AUA), along Merced R. in Little Yosemite Valley, *R. Bacigalupi 1849* (POM), 5 mi. SW of Yosemite Tunnel, *L. Benson 7703* (POM), Footman Mt., *J. W. Congdon in 1887* (MIN), Snow Creek, *J. W. Congdon in 1883* (MIN), Biledo Meadows S of the Mariposa Big Tree Grove, *D. B. Dunn 1940* (UMO), Yosemite, Little Crane Creek, *H. M. Hall & E. Babcock 3423* (DS, POM, RM, UC), Wawona Valley, *J. T. Howell 390* (CAS), Yosemite National Park, Happy Isles, *S. W. Hutchinson 1452* (NO), Grouse Creek, Yosemite to Wawona, *W. L. Jepson 4286* (JEPS), near summit of Chowchilla Mt., *C. Quick 45-41* (CAS), Yosemite National Park, Round Mt., *H. K. Pratt 24* (ISC), Vernal Falls, *J. Redfield 2390* (MO), S of Mirror Lake, *B. Schreiber 1702* (UC), Yosemite, near Tioga Road, *E. E. Stanford 1909* (RM); MENDOCINO COUNTY, Big River, *J. McMurphy 199* (DS, NY, US), 3 mi. up Ten Mile R., *F. Peirson 3789* (RSA), Van Damme State Park, *F. Peirson in 1941* (RSA), Van Damme State Park, Fern Canyon, *P. H. Raven & R. Snow 13669* (CAS, GH, RSA), SE of Albion, *H. Ripley & R. Barneby 6859* (CAS); MODOC COUNTY, Warner Mts., Cedar Canyon, Stow's Meadow, *F. H. Frost 66* (JEPS), Modoc National Forest, *R. Thomas & C. Tilforth 39175* (CAS), Parker Creek, *F. Payne 801* (CAS), Taylor Creek near Forestdale, *F. Nutting s.n.* (UC), *M. S. Baker in 1893* (JEPS, UC); NEVADA COUNTY, Donner Pass region, *H. M. Pollard in 1936* (B), Truckee, *C. F. Sonne in 1884* (UC), Summit, Soda Springs, *P. B. Kennedy 259* (RM, UC), *M. E. Jones 2761* (POM), Rucker Lake, *P. H. Raven 10060* (CAS), Bear Valley, *W. L. Jepson in 1898* (JEPS, MO), Evers Valley to Frog Lake, *J. T. Howell 18757* (CAS); PLACER COUNTY, Emigrant Gap, *M. E. Jones in 1882* (POM), Flume below Emigrant Gap, *F. A. MacFadden 12562* (BHO, CAS, IDS, NY), Lake Tahoe, Chambers Lodge, *L. Rose 44239* (TEX), under rocks on Mueller R., *C. F. Sonne in 1884* (CM), under rocks on Tucker R., *C. F. Sonne 116* (CM), Cisco, near to Iron Spring, *H. Walker 1454* (NMC, POM, UC), Tahoe Forest, base of Twin Peaks, *W. W. Eggleston 21658* (NY, US); PLUMAS COUNTY, near Lassen Buttes, *H. Brown 635* (DS, MO, NY, US), Prattville, *A. Coombs in 1906* (GH), Greenville, Forest Lodge, *A. Eastwood in 1927* (CAS), Quincy, *W. W. Eggleston 7633* (NY, US), Lassen National Park, upper Willow Lake, *G. Gillett 802* (CAS, JEPS), near Prattville, *J. T. Howell 2174* (CAS), Drakesbad, *J. T. Howell 35797* (CAS), NW of Willow Lake, *J. T. Howell 35856* (CAS, MAK), S of Quincy, *D. Keck 1641* (DS), headwaters of Clear Creek, *C. Quick 1342* (CAS), Quincy, Gansner Creek, *R. Weatherby 1451* (CAS, NY, RM, RSA, UC), 4th Water, Bear Creek, Middle Fork Feather R., *R. Weatherby 1654* (NY, RSA, UC), Meadow Valley, U.S. Forest Service Camp, *R. Weatherby 1678* (DS, RSA), Big Meadows, *R. Austin in 1880* (NA), Mill Creek, *R. Austin in 1877* (NY); SAN BERNARDINO COUNTY, San Bernardino Mts., Green Valley, *J. B. Feurge 1447* (POM), Lake Arrowhead, *E. Kline in 1924* (UARK), San Bernardino National Forest, along Snake Creek E of Lake Arrowhead, *L. DeBuhr et al. 670* (ISC), 1 mi. N of Heap's Peak, *C. Tilforth et al. 594* (DS, RSA), N of Crestline, *J. Roos 2728* (POM), Bluff Lake, *P. A. Munz 10693* (NY, POM, RM, RSA, UC), Little Bear Valley, *H. M. Hall 1000* (MO, UC), *H. M. Hall 1296* (NY), Bluff Lake, *G. Goodman & C. Hitchcock 1757* (ILL, MO, MONTU, NY), Strawberry Peak, *L. R. Abrams 2016* (DS, MO, NY, POM), Sawpit Canyon, W of Job's Peak, *J. Ewan 3546* (NO), *J. Ewan 5160* (CAS, DS, POM, UC), San Bernardino Mts., *S. & W. Parish 1158* (DS, ISC, MO, US); SHASTA COUNTY, E of Round Mt., Hatchet Creek, *L. Benson 2208* (DS, MO, NY, POM, UC, US), Hatchet Creek Summit, Hatchet Mt. on hwy 299, *V. & A. Grant 8000* (UC), Goose Valley, *A. Eastwood 881* (BH, CAS, GH), Lassen Volcanic National Park, 0.25 mi. above Manzanita Creek on Chaos Crags Trail, *G. Gillett 709* (CAS, JEPS); Sierra County, Pioneer Road Station, 2 mi. E of Bassett Station, N Fork Yuba R., *W. L. Jepson 16806* (JEPS), Girl Scout Camp near Bassett, *J. Kuijt 2372* (NCU, UBC); SISKIYOU COUNTY, Mill Creek, *L. R. Abrams 8469* (POM), Marble Mts., Sky High Valley, *A. Alexander & L. Kellogg 5874* (DS, MICH, MO, RM, UC, US, WTU), 1 mi. N of Forest Camp, Etna, *D. Barbe 061* (RSA, UC), Payne's Springs, *M. Baker 494* (UC), Shackelford Creek, *G. Butler 1499* (DS, POM, RM, UC, US), Klamath National Forest, Happy Camp to Waldo, Oregon Road, *A. Carter 706* (DS, GH, NY, UC), Mt. Shasta, along Mud Creek Dam road, *W. B. & V. G. Cooke 45455* (JEPS), W bank of Mud Creek Canyon, *W. B. Cooke 13860* (OSC), Mud Creek Canyon, *W. B. Cooke 15464* (NA, ND), near McCloud, *W. Dudley in 1899* (DS), Shasta Springs, *A. Eastwood 11030* (CAS), S Fork Salmon R. between campground and Carter's, *W. Ferlatte 1034* (RSA), T37N, R9W, Sec. 31, *W. Ferlatte 284* (RSA), near Jackson Lake, *E. Greene* (US), near Cudahy Lakes, *C. Hardham 13036* (RSA), NE base of Mt. Eddy, Metcalf's Ranch, *A. Heller 13251a* (CAS, DS, GH, ILL, MO, NY, PENN, PH, US, WIS, WTU), S Fork Salmon R. near Big Flat, *J. T. Howell 13367* (CAS), Marble Mts., Spirit Lake, *J. T. Howell 14982* (CAS), Little N Fork Salmon R. near mouth, *D. Kildale 5444* (DS), between Sawyer's Bar and Etna's Mill, *D. Kildale 5533* (DS), Elk Lick, S Fork Indian Creek, *D. Kildale 8754* (DS), beside Black Mt. at creek, *G. Muth 237* (RSA), Marble Mt. Wilderness Area, vicinity of English Peak, *F. Oettinger 480* (RSA, UC), Salmon Mts. Range, near Etna Creek, *D. Parker in 1949* (UC, WVW), ca. 6 mi. SE of Cecilville, *H. & J. Thomas 4410* (DS), near Donomore Meadow, just S of the Oregon state line, *R. Waring 298* (OSC), China Creek, *I. L. Wiggins 13469* (DS, NY, UC, WS), Etna Mills, *J. P. Young in 1921* (CU); SONOMA COUNTY, Guernville, *V. Rattan in 1877* (CAS, RSA); TEHAMA COUNTY, ca. 40 mi. NE of Chico along hwy 32, Soda Springs Campground, *G. Evans in 1963* (UTC), Bluff Falls, *J. T. Howell 36066* (CAS,

OSC), Deer Creek Pass, A. R. & H. N. Moldenke 24832 (LL), Salmon Mts., Coffee Creek, H. M. Hall 8529 (DS); TRINITY COUNTY, Trinity Mts., Morris Meadows, A. Alexander & L. Kellogg 5515 (DS, RM, UC, US, WTU), 18 mi. NW of Weaverville, E. Carter 645 (CAS), Mud Springs, Trinity Summit, J. Davy & W. Blasdale 5775 (US), T37N, Sec. 7, Big Flat, W. Ferlatte 706 (RSA), Coffee Creek, H. M. Hall 8529 (RM, UC, US), Big French Creek near Cobbs, L. B. Kildale 10184 (BH), above Forest Glenn, P. A. Munz 14356 (POM), Big Flat, L. Rowntree in 1937 (TEX), Carville, E. Van Dyke in 1931 (CAS), ca. 14 mi. NW of Trinity Center, E. G. Voss & T. F. Groesbeck 13067 (MICH, WTU), ca. 1.5 mi. S of Trinity Center, Wagon 1750 (RSA), South Fork Mt., 5.7 mi. S of Cold Spring Lookout, C. B. Wolf 9169 (NY, RSA, TEX); TULARE COUNTY, Sequoia National Park, Giant Forest, R. Bebb 336 (OKL), K. Brandegee in 1905 (US), A. Cronquist 2037 (MO, ND), L. M. Newlon 15 (JEPS), below Mineral King, Y. Winblad in 1937 (CAS), Crane Meadow, E. Twisselman 10139 (DS), near trail from Soda Spring to Quaking Aspen, C. Smith 1232 (JEPS, RM, UTC, WTU), 5.4 mi. from Posey on road to White River, P. H. Raven et al. 14353 (RSA), Nelson on Tule R., F. Peirson 2089 (RSA), vicinity of Mountain Lake, W. Dudley 926 (DS), Thorp's Meadow, W. Dudley 3014 (DS), vicinity of Mt. Moses, W. Duncan in 1923 (DS); TUOLUMNE COUNTY, Brightman's Flat, A. L. Grant in 1916 (CU, JEPS), Dodge Ridge Road, 3 mi. from Pinecrest, V. F. Hesse 2285 (JEPS), ca. 3 mi. NE of Strawberry, R. Kral 21756 (VDB), Hetch Hetchy, H. Mason 632 (DS, GH, NY, UC), Smith Peak Trail from Mather, H. Mason 2191 (POM, UC), Mather, Acherson Meadow, P. A. Munz 7436 (POM), Leland Meadows, C. Quick in 1930 (MO), near Cow Creek Guard Station, Sonora Pass Hwy, C. Quick 40-87 (CAS), 3 mi. W of Pinecrest, Lair of the Golden Bear, P. H. Raven 20332 (DAO, DS, RSA, US), 3.5 mi. above Pinecrest on road to Bell Meadows, Gooseberry Camp, I. L. Wiggins 8997 (DS, RSA, WS). COLORADO: BOULDER COUNTY, Gregory Canyon, H. W. Campbell 595 (COLO), Rangers trail to summit of Green Mt., J. Ewan 11239 (CAS, GH, ND, RSA), Green Mt., Twin Springs, J. A. Ewan 12250 (NO), J. A. Ewan 12251 (CAS, RSA, UC, WS), N slope of Bear Mt. above Boulder, Fern Canyon, J. A. Ewan 12078 (CAS, NO, RSA), Coal Creek Canyon, SW of Eldorado Springs, J. A. Ewan 14379 (CAS, COLO, ILL, NO, RSA), SW corner of Boulder city limits along Royal Arch Trail, E. Haber & D. R. Given 1997 (CAN, DS, SASK, V), 4 mi. SW of Boulder, J. Murdock 424 (BRY), Boulder, G. Osterhout 4631 (NY), 4-5 mi. SW of Boulder, G. Robbins 786 (UC), mesa S of Boulder, F. Ramaley 5099 (ORE); JEFFERSON COUNTY, Turkey Creek Canyon, P. A. Munz 150 (CU), Golden, in Coal Creek Canyon, Johnston & Hedgcock 395 (RM); LARIMER COUNTY, Fort Collins, L. H. Pammel in 1896 (ISC); MESA COUNTY (?), Mesa, W. W. Robbins in 1908 (COLO). IDAHO: ADA COUNTY, Boise, J. F. Macbride 251 (GH, IA, MIN, MO, RM); BANNOCK COUNTY, Scout Camp, R. J. Davis 152-35 (IDS), Chatcolet, C. Coziero in 1904 (WS); BOISE COUNTY, Squaw Butte, J. A. Clarke 271 (BH, CAN, DS, GH, MIN, MO, RM), ca. 3 mi. N of North Fork Boise R. on Little Owl Creek, C. L. Hitchcock & C. V. Muhlick 10052 (CAS, DS, GH, NCSC, NY, RM, UC, UTC, WS, WTU); BONNER COUNTY, mouth of Hunt Creek, Priest Lake, W. H. Baker 16041 (ID, WTU), 4 mi. W of Priest Lake, Lambs Creek, W. H. Baker 16510 (ID), Priest R. at Huot's Landing, J. H. Christ 925 (NY), Pack R. on Lake Pend Oreille, J. H. Christ 431 (NY), Big Lightning Creek at Clark's Fork, J. H. Christ 148 (NY), Priest R. Experimental Forest, R. F. Daubenmire 43307 (NY, WS, WTU), C. C. Epling 6384 (MIN, SMU, US), Lake Pend Oreille, M. B. Dunkle in 1914 (ID), W slopes, Priest River Range, J. B. Leiberg 2730 (ORE, US), 5 mi. W of Sand Point, J. H. Ehlers & C. O. Erlanson 51 (MICH); BOUNDARY COUNTY, Upper Priest R., E. Epling 7324 (MO), 19.5 mi. NNW of Sandpoint, P. F. Stickney 1712 (ID); CASSIA COUNTY, Raft R. valley, D. D. Biggers in 1929 (ID), Basin, K. T. Harper 1119 (UT), 13.5 mi. S of the town of Rock Creek, N. H. Holmgren 6175 (ARIZ, ASU, BRY, KANU, NY, US, UTC, WTU); CLEARWATER COUNTY, 10 mi. E of Boville, A. Cronquist & Q. Jones 5983 (CAN, COLO, DAO, DS, GA, GH, ID, ILL, KANU, MICH, MT, NY, RSA, TEX, UC, US, UTC, WS, WTU), Oviat Meadows, D. Wagner 89 (WS), Shanghai Mt., R. L. Lingfelter 488 (DS, IDS, MT, NY, RSA, SMU, UC, WS, WTU), Clearwater National Forest, 7 mi. W of Bungalow Ranger Station, W. H. Baker 14460 (ID, RSA); ELMORE COUNTY, Manyon Creek, J. F. Macbride 579 (RM), Boise National Forest, Bear Creek, F. A. MacFadden 15553 (ISC, OKLA); FREMONT COUNTY, Big Springs, J. H. Christ 5615 (NY), Big Springs, 5 mi. E of Yellowstone Hwy, A. Cronquist 1607 (IDS, MO, ND, UTC), Henry's Fork of Snake R., just below Big Falls, A. Cronquist 1789 (IDS, MIN, UTC); IDAHO COUNTY, Nez Perce National Forest, above the Selway at Falls Point Lookout, W. H. Baker 12456 (ID, RSA), near mouth of Meadow Creek, S of Selway R., W. H. Baker 14247 (ID), Selway R. above Selway Falls, L. Constance & R. Rollins 1664 (POM, WS), 14 mi. E of Kooskia along U.S. route 12, G. Davidse & A. Collotzi 605 (UTC), 7.5 mi. SSE of Grangeville, R. Daubenmire in 1959 (WS), ca. 5 mi. W of Riggins on road to 7 Devils, C. Davidson 1607 (RSA), 2 mi. S of Pollock, R. J. Davis 2382 (IDS, POM), Lowell, R. J. Davis 3538 (IDS, POM), near Lowell, C. L. Hitchcock & C. V. Muhlick 14696 (NY, WTU), 3 mi. W of Lowell, Q. Jones 62 (DS, GH, MIN, RSA, SMU, WS, WTU), Sharp Creek, 1.5 mi. from its mouth, J. Packard 573 (UC, WS), 5 mi. up Slate Creek from Salmon R., J. H. Christ & W. Ward 7756 (NY); KOOTENAI COUNTY, Sandpoint Substation, Leiberg Trail, J. H. Christ & N. Teape 3428 (NY), Cour d'Alene, H. J. Rust 290 (ID, NY), Hayden Creek Canyon, H. J. Rust 147 (ID), 4 July Canyon, J. B. Leiberg 1337 (GH,

MIN, NMU, NY, ORE, POM, RM, UC, US), in the Palouse Country and about Lake Coeur d'Alene, *G. B. Aiton in 1892* (MIN, RM, WIS); Latah County, Paradise Ridge, Moscow, *W. H. Baker 1326* (ID), Moscow Mts., *L. F. Henderson in 1894* (CU, DS), Thatuna Hills, *C. Epling & Hauch 9036* (MO, US), S slope Moscow Mt., Palouse Range, *B. W. Chichester 1198* (ID), S of Helmer, *J. H. Christ & F. Gail 6908* (ID, NY), Thatuna Ridge, *R. F. Daubenmire 37446* (WS), N of Lookout, *R. F. Daubenmire 59106* (WS), E side of Moscow Mt., *X. M. Gaines 309* (WS, WTU), 5 mi. ENE of Moscow, *L. K. Henry in 1969* (CM), E Hatter Creek, *G. R. Lockard in 1961* (ID), St. Joseph National Forest, *R. Ogilvie in 1956* (DAO, UBC), Cedar Mt., *C. V. Piper 3579* (GH, WS), W slope of Bald Mt., *E. L. Richards 102* (ID); LEMHI COUNTY, Camp Tendoy, *R. J. Davis 152-35* (IDS), Salmon, *E. B. & L. B. Payson 1753* (BH, CAS, GH, H, MO, NY, RM), 12 mi. W of Salmon, *J. H. Christ 14683* (ID, WS, WTU); NEZ PERCE COUNTY, Munro's Fountain, Lake Waha, *R. K. Beattie in 1902* (WS), E of Lewiston, *J. H. Sandberg et al. 289* (DS, IA, MO, NY, ORE, POM, TEX, US), Ravine N of Lewiston, *R. F. Daubenmire in 1972* (WS), Lake Waha, *A. A. & E. G. Heller 3314* (CU, DAO, MIN, NDG, NY, UC, US, WIS); POWER COUNTY, ca. 15 mi. WSW from Pauline, Knox Canyon, *S. Welsh et al. 17372* (BRY); SHOSHONE COUNTY, mouth of Bullion Creek, *W. H. Baker 13499* (ID, RSA), N Fork St. Joe R., Avery, *Richardson in 1936* (ID), 10-12 mi. above Clarkia, along St. Maries R., *C. B. Wilson 109* (BH, GH, IDS, MO, US, WS), Clearwater Camp on Little North Fork of Clearwater R., *C. B. Wilson 462* (IDS, WS), Swamp Creek, *L. Abrams 798* (DS, NY); TETON COUNTY, S of Victor, *J. H. Christ 5298* (NY); VALLEY COUNTY, McCall, *H. Tucker 9116* (NY), Payette National Forest, W of Cascade, *J. W. Thompson 13851* (BH, CAS, DS, DUKE, GH, MICH, MO, NY, PENN, PH, POM, UC, US, WTU), Boise National Forest, head of Silver Creek, *M. Lewis 2407* (UTC); WASHINGTON COUNTY, Middle Fork Weiser R., *M. E. Jones in 1899* (POM). MONTANA: FLATHEAD COUNTY, Glacier National Park, W side of Logan Pass, *P. C. Hoch 1509* (BM, CM, E, G, K, KYO, MHA, MO, NCU, P, PE, SHIN, TUS), Blackfoot Glacier, *M. E. Jones in 1909* (POM), W side of Glacier National Park, *W. McCalla 3785* (ALTA), Lake McDonald, *L. Umbach in 1901* (WIS), *F. Vreeland 970* (CAN, MONTU, NY, US), Swan Mt. Range, *E. Chadwick 160* (MONTU), N Swan Range, Krause Creek, *J. Antos 318* (MONTU), Glacier National Park, Mt. Cannon, *L. H. Harvey 6064* (MISS, MONTU), Avalanche Camp Ground, *J. H. Thomas 11151* (DS); GALLATIN COUNTY, near Bozeman, Mt. Bridger, *J. W. Blankenship 197* (CAN, DS, H, MO, MONTU, MT, NEB, PH, POM, RM, UC, US); GLACIER COUNTY, Glacier National Park, between Lake Josephine & Lake Grinnell, *D. H. Brant 123* (WTU), woodland about Swift Current Lake, *B. Maguire 920* (UTC), 2 mi. below Gunsight Lake, *B. Maguire 921* (CU, POM, UC, UTC), 2 mi. below Grinnell Lake, *B. Maguire 922* (CU, MO, POM, UC, UTC); GRANITE COUNTY, Harrys Flat Camp, Rock Creek Canyon, *C. L. Hitchcock & C. V. Muhlick 14394* (NY, WS, WTU); LAKE COUNTY, Mission Creek, Upper Falls area, *W. P. Cottam 17233* (COLO, DAL), Flathead Lake, Yellow Bay, *Mrs. J. Clemens in 1908* (DS), *M. E. Jones 8406* (POM), *D. H. B. Ulmer, Jr. 560* (DUKE), Flathead Lake, Tepee Creek, E lakeshore, *L. R. Reynolds 192* (DUKE, MONTU, NCU), Skidoo Creek ca. 5 mi. from hwy 35, *D. Woodland 601* (DS, MONTU), Big Draw, Mill Creek Road, *L. H. Harvey 5038* (MONTU); LINCOLN COUNTY, Spar Lake, *L. H. Harvey 5473* (MONTU); MISSOULA COUNTY, above Bonner, Blackfoot Valley, *C. L. Hitchcock 1659* (CAS, MONTU, POM, RM), Missoula, *E. S. Janson in 1928* (MICH), Sapphire Mts., Plant Creek tributary of Miller Creek, *D. Ramsden 11* (MONTU), 4 mi. SW of Clinton, Lolo, W Fork Schwartz Creek, *P. F. Stickney 637* (MONTU, WTU); RAVALLI COUNTY, Bitterroot Mts., St. Regis Creek, *W. R. Sweadner in 1932* (CM), off lower St. Mary's Road, *K. H. Lakschewitz 5124* (COLO); COUNTY UNKNOWN; Prickly Pear Canyon, *R. S. Williams 650* (MIN, US), Big Belt Mts., Deep Creek Canyon, *J. W. Blankenship in 1899* (ISC, MONTU, NMU, RM), Midvale, *L. M. Umbach 668* (DS, MIN, NMU, NY, US, WIS). NEVADA: DOUGLAS COUNTY, Glenbrook, *C. F. Baker 1342* (GH, MO, NDG, NY, POM, US), 10-15 mi. SW of Carson on King's Canyon Road, *T. L. Breene 616* (ARIZ, NA, POM), 2 mi. W of Lake Tahoe junction, Kingsbury Grade, *H. L. Mason 12183* (DUKE, ID, UC), summit of Kingsbury Grade, *L. Mills & K. Beach 1252* (NA), Daggett's Pass, *A. M. Otley 995* (CU), Glenbrook on Lake Tahoe, *I. Tidestrom 10318* (US); ELKO COUNTY, Humboldt Forest, Lime Creek, *B. Crane in 1937* (UTC), right fork of Lamoille Canyon, *L. L. Loope 1050* (DUKE), 2.5 mi. above town of Jarbridge, *P. Train 806* (DAO, DS, MO, NA, NY, POM); ORMSBY COUNTY, Lake Tahoe, *K. H. Beach 230* (KSC), Carson City, Carson Range, *A. Pinzl 951* (NY); WASHOE COUNTY, Lake Tahoe, Creek at Incline, *W. A. Archer 6701* (ARIZ, DS, MICH, MO, NA, NY, POM), 25 mi. SW of Reno, *W. A. Archer 5884* (DAO, NA, POM, UC), vicinity of Reno, *A. Hitchcock 485* (US), Hunter Creek Canyon, *P. B. Kennedy in 1912* (DS), near Franktown, Lewer's Ranch, *P. Lehenbauer in 1929* (NA), W side of Little Valley, *H. Mazingo in 1971* (NLU). NEW MEXICO: CATRON COUNTY, ca. 10 air mi. ESE of Mogollon in Gila Wilderness, *R. Spellenberg et al. 4505* (NY); LINCOLN COUNTY, White Mts., vicinity of Rio Bonito, W of Bonito Lake, *B. Hutchins 3490* (UNM); OTERO COUNTY, White Mts., Mescalero Reservation, Ruidosa Creek, *L. C. Hinckley 720* (ARIZ, GH, NY, TEX). OREGON: BAKER COUNTY, Kettle Creek Camp, *G. Mason 6296* (ORE, OSC), near Head's Cabin, *S. C. Head 1075* (OSC, RSA), Blue Mts., Anthony Creek, *H. Ripley & R. Barneby 9476* (RSA); BENTON COUNTY, Corvallis, *H. C. Gilbert 30* (OSC), Philomath, *M. Stason*

in 1925 (UC), near Philomath, *C. Gregg* in 1956 (RSA), Kings Valley, *B. Miller 104* (OSC), upper Greasy Creek, *E. Hansen* in 1939 (DS), Boy Scout Camp at foot of Alsea Mt., *Mrs. J. Smith* in 1960 (OSC, PENN); CLACKAMAS COUNTY, Mt. Hood, Alder Creek, *J. W. McFarland* in 1941 (BH), Rhododendron, *D. Overlander* in 1945 (KANU, OSC, TEX, WS), Milwaukie, *W. N. Suksdorf* in 1893 (WS); COOS COUNTY, 2 mi. above Broadbent, *L. Henderson 10153* (ORE), Arago, *T. Lammi* in 1939 (OSC), Coos Bay, head of Coos River, *H. D. House 4833* (US); CROOK COUNTY, Ochoco Mts., between Pineville & Mitchell, *A. Cronquist 7374* (NY, WS), Ochoco National Forest, upper Scisson Creek, *M. Kucera 206* (WS), Blue Mt. between Mitchell & Pineville, *H. Mason 3572* (UC); CURRY COUNTY, near Lowery's, 16 mi. below Agness, *L. Henderson 11703* (ORE), 4 mi. N of Port Orford, *M. Peck 8592* (BH, GH, MO, NY), ca. 12 mi. from Powers, *L. Leach 2428* (ORE); DESCHUTES COUNTY, Four-mile Spring, *L. Detling 5789* (ORE), Deschutes National Forest, Sister's Ranger Station, *R. Ferris & R. Duthie 587* (DS); DOUGLAS COUNTY, 0.5 mi. S of Glide, *E. Earle 4908* (NY, PENN), ca. 20 mi. W of Crater Lake, SE of Elephant Head, *R. Mitchell 222* (OSC), Cow Creek, 1 mi. below Nichols Station, *L. Ward 57* (US); Grant County, 12 mi. S of Dayville, *A. Cronquist 7610* (NY, RSA, WS, WTU), Blue Mts., near Dixie Station, *L. Henderson 5633* (CAS, DS, MO, ORE), 21 mi. E of Seneca, Lake Creek Guard Station, *A. N. Steward 6951* (CAS, DAO, GH, ISC, OSC, UBC, WTU), John Day R. near mouth of Widow Creek, *M. E. Peck 10148* (DS, POM); HARNEY COUNTY, Emigrant Creek, *M. E. Peck 3748* (WILLU), Blue Mts., Sawtooth Creek, *L. F. Henderson 8884* (CAS, ORE), 12.5 mi. E & 9.75 mi. due S of Frenchglen, *C. G. Hansen 841* (OSC); HARNEY-GRANT COUNTIES, Lonesome Creek Area, Malheur National Forest, *D. B. Pingley* in 1961 (WVA); HOOD RIVER COUNTY, Mt. Hood, S slope, *L. Benson 2524* (DS, MO, NY, POM, US), Mt. Hood National Forest, Tilly Jane Creek, *Evinger & Goodding 653* (OSC), Dry Creek Falls, Cascade Locks, *T. Gustafson 78* (OSC), Locks, *L. F. Henderson 831* (MO), Eagle Creek near Bonneville, *N. W. Rickett 1608* (UMO); JACKSON COUNTY, Wimer, *E. Hammond* in 1892 (CM, RM, US), Grizzly Peak, NE of Ashland, *H. Mason 4069* (UC), Sykes Creek, *E. Hammond 150* (ISC, MO), Miller Lake Trail, *H. M. Gilkey* in 1940 (OSC), Johnson Prairie along Jenny Creek, *E. I. Applegate 5207* (DS), along Beaver Creek, *F. Hoffman 2550* (UC); Jefferson-Deschutes County line, Black Butte, NW of Sisters, *J. M. & M. Johnson 483* (DS, OSC, US); JOSEPHINE COUNTY, W Fork of Williams Creek below Cave Camp, *E. I. Applegate 8712* (DS), Deer Creek Valley, *H. L. Dale* in 1919 (DS), Oregon Caves to Mt. Elijah, *L. Detling 6478* (ORE), T40S, R5W, Sec. 21, *R. Waring 756* (OSC), Oregon Caves National Monument, Big Meadow, *E. I. Applegate 10551* (DS), Williams Creek Trail near Oregon Caverns, *R. Beattie 5612* (US), Siskiyou Mts., Grayback Creek, *R. H. Whittaker 5593* (WS), Dwight Creek on Redwood Hwy, *D. K. Kildale & J. W. Gillespie 8141* (DS); KLAMATH COUNTY, Nelson Creek, N end of Swan Lake valley, *E. I. Applegate 4406* (DS, WILLU), Crater Lake National Park, Redblanket Canyon, *W. H. Baker 7074* (ID, NY, RSA, WS), Crater National Forest, branch of Cherry Creek, *J. Rose 1066* (MO), Crater Lake National Park, bottom of Anna Creek Canyon, *E. I. Applegate 10902* (DS, WS), W side of Klamath Lake, mouth of Cherry Creek, *F. Coville & E. I. Applegate 300* (US); LAKE COUNTY, 8 mi. S of Lakeview, *M. E. Peck 14338* (WILLU); LANE COUNTY, 2 mi. W of Coburg, *W. H. Baker 884* (ID, OSC), Fairview Mt., W slope, *W. H. Baker 1029* (ID, OSC), woods of Spencer Butte, *R. Brown 107* (ORE), E of Eugene, Camp Creek, *L. Constance* in 1928 (UC), Swiss Home, *L. Detling 2884* (ORE, UC), River Camp Forest Campground, N Fork Willamette R., *O. Ireland 1521* (ORE), 15 mi. SW of Junction City, *G. Mason 10233* (ORE), Horse Creek, *M. Gorman 1656* (US); LINCOLN COUNTY, 2 mi. W of Harland, *L. J. Dennis 2722* (NCU, NLU, OSC, TUR, UMO, UTC); LINN COUNTY, SW base of Mt. Jefferson, *Parmelia*, *M. E. Peck 9230* (MO, WILLU), Crabtree, *D. W. Hatch 21* (OSC), Santiam R., *H. M. Gilkey* in 1934 (OSC), near Fish Lake, *E. I. Applegate & F. Coville 618* (DS, ND, US), N side Peterson Butte, *L. Whitaker* in 1938 (OSC), W of Corvallis on Mary's Peak, *H. Gilbert 30* (US); MARION COUNTY, Gates, *M. Gorman 4102* (PH, WS), Detroit, *M. Gorman 4108* (DS, PH, TEX, WS), Salem, *M. E. Peck 3750, 3751* (WILLU), Silverton, *J. C. Nelson 157* (DS), 0.5 mi. E of Orville, *J. C. Nelson 3760* (PH); MULTNOMAH COUNTY, Portland, *A. Kellogg & W. Harford 989* (US), *F. Kelsey* in 1888 (NY), *G. H. Hicks 206* (MIN), *L. F. Henderson 363* (OSC), Sauvie's Island, *T. Howell* in 1881 (MIN, OSC), Columbia Gorge E of Crown Point, *L. Detling 7108* (DS, ORE), hills of W Portland, *J. W. Thompson 235* (DS, WTU), banks of Columbia R. below Oregon, *J. Donaldson* in 1946 (OSC), Mt. Scott, *E. P. Sheldon 512282* (DS, ORE, TEX); TILLAMOOK COUNTY, N Fork Wilson R. a few mi. downstream from Blue Lake, *K. L. Chambers 4101* (OSC), Miami River, *G. E. Merrill 201* (ND, WTU); UMATILLA COUNTY, 5 mi. W of Meacham, *M. E. Peck 3749* (WILLU); UNION COUNTY, ca. 3 mi. E of Cove, *G. Mason 2436* (ASU), ca. 2.5 mi. N of Boulder Park, *G. Mason 5446* (ORE); WALLOWA COUNTY, S of Enterprise, *D. Cole 182A* (ORE), near BC Creek at Wallowa Lake, *G. Mason 5227A* (OSC, RSA), 2 mi. from Power House Road on Lake Basin Trail, *G. Mason 5835* (ORE), ca. 2 mi. S of Joseph, *G. Mason 7903* (ASU), Horse Creek Canyon, *E. Sheldon 8145* (GH, MO, NY, RM, WTU), Downey's Gulch, *E. Sheldon 8322* (NY); WASHINGTON COUNTY, Forest Grove, *J. W. Thompson 867* (DS, WTU), Scroggin's Valley, *J. W. Thompson 4297* (DS, MO, OKLA); WHEELER COUNTY, Widow's Creek, *M. E. Peck 10148* (WILLU), Ochoco National Forest, *S. Warg* in 1933 (OSC). UTAH: BOXELDER COUNTY, Raft River Mts., George

Creek Canyon, *S. J. Preece, Jr.* 815 (RSA, UT), Perry Canyon, *W. P. Cottam et al.* 16228 (UT); CACHE COUNTY, Wellsville Mts., near the top of Schaefer Canyon, *P. Camp in 1967* (UTC), Wellsville Canyon, *W. S. Flowers* 1711 (UT), Logan Canyon, *B. Maguire* 13868 (BRY, DAO, UTC, WTU), 13869 (BRY, WTU); DAVIS COUNTY, Wasatch Mts., Mueller's Park, *J. L. Moore* 100 (LTU, UT); JUAB COUNTY, Mt. Nebo, at Loop Spring, *F. Peabody* 790 (BRY); MORGAN COUNTY, Wasatch Mts., Peterson Canyon, *Pammel & Blackwood* 3797 (ISC, MO); SALT LAKE COUNTY, Wasatch Mts., Alta, *M. E. Jones* 1276 (CM, GH, MICH, NY, POM, US), near Salt Lake City, City Creek Canyon, *M. E. Jones in 1880* (POM), *F. E. Leonard in 1883* (ISC, NY), Silver Lake, American Fork Canyon, *M. E. Jones in 1895* (ORE, RM), E of Salt Lake City, Red Butte Canyon, *L. Arnow* 1834 (NLU, RSA, UT), 2219 (BRY, UT, UTC), *J. Clemens in 1909* (MO), Moss Falls, Big Cottonwood, *W. P. Cottam* 8353 (UT), *B. Harrison* 9443 (BRY), Emigration Canyon, *C. Smith* 1854 (RM, UTC), Neffs Canyon, *S. Winburn in 1971* (UT); UTAH COUNTY, Mt. Timpanogos, Bear Canyon, *K. Allard* 451 (BRY), Mt. Timp, *W. P. Cottam* 1235 (BRY), Provo, *M. Tracy s.n.* (COLO), Wasatch Range, Big Tree Campground, *W. P. Cottam et al.* 15095 (ARIZ, DS, RSA, UC, UT, WTU), Aspen Grove, *S. Flowers* 148 (UT), Provo Canyon, Bridal Veil Falls, *S. L. Welsh* 3229 (BRY, ISC); WEBER COUNTY, N Fork Ogden R., trail to Ben Lomond, *S. Clark* 2098 (BRY), Ogden, *G. W. Letterman in 1885* (MIN), N of Snow Basin Road, Wheeler Creek, *S. Clark* 2177 (BRY). WASHINGTON: ASOTIN COUNTY, Cottonwood Creek SW of Anatone, *A. Cronquist & Q. Jones* 5940 (CAN, COLO, DAO, DS, DUKE, GA, ID, ILL, KANU, MICH, MIN, MT, NCSC, NY, RSA, SMU, TEX, UC, US, UTC, WS, WTU, WVA); CHELAN COUNTY, Entiat Valley, Silver Creek, *G. E. Merrill* 259 (WTU), Horseshoe Basin, *H. St. John & L. Ridout* 3578 (MT, WS), Wenatchee National Forest, valley of White R., *H. St. John* 4794 (WS), Bridge Creek near Chelan Lake, *M. E. Jones in 1911* (DS, POM), Chelan Lake, Stehekin, *M. E. Jones in 1911* (POM); CLALLAM COUNTY, Lake Crescent, *H. & S. Parks* 0669 (UC), Olympic Mts., *A. D. E. Elmer* 2564 (DS, MIN, MO, NY, ORE, POM, SMU, US, WS), Port Crescent, *W. H. Lawrence* 246 (MO, NA, WS), Olympic National Park, 8.6 mi. S of the entrance to Heart of the Hills, *R. Riggins* 763 (ISC), Mt. Angeles, *E. B. Webster* 46 (NDA), Hurricane Ridge, *E. B. Webster* 1238 (WTU), Olympic Mts., along Elwah R., vicinity of Altaire Public Camp, *I. L. Wiggins* 9416 (DS, GH, NY, RM); CLARK COUNTY, Lacamas Creek, *C. English, Jr.* 462 (BH, US); COLUMBIA COUNTY, Wenaha Forest Reserve, Blue Mts., Tallow Flat, *N. T. Darlington* 137 (WS), along Tukanon R., *Lake & Hull* 533 (NY); FERRY COUNTY, 15 mi. W of Kettle Falls, Sherman Creek, *L. Boner & V. Weldert* 238 (CAS, DS, GH, MIN, NY, RM, UTC, WS, WTU), Barnaby Creek at its confluence with the Columbia R., *H. T. Rogers* 567 (GH, MO, NY, POM, UC, WS, WTU); GARFIELD COUNTY, Tucannon R. T8N, R42E, Sec. 7, *M. Barkworth* 440 (WS); GRAYS HARBOR COUNTY, Stevens Creek, *G. N. Jones* 3947 (DS, POM, WTU), Hoquiam, *F. H. Lamb* 1136 (MO), Montesano, *J. M. Grant in 1918* (GH, MO), vicinity of Quinault Ranger Station, *A. Lasseigne in 1973* (ISC); ISLAND COUNTY, Camano Island, *N. Gardner in 1895* (UC), Whidbey Island, Deception Pass Park, *H. W. Smith* 1054 (WS); JEFFERSON COUNTY, Hoh R., *I. C. Otis* 1289 (WS), head of Big Quilcene R., *J. W. Thompson* 7929 (GH, MO, NO, PH, UC, WTU), S side of Olympic National Park, Quinault Rain Forest, *T. G. Yuncker & W. H. Welch* 18893 (NCU, UC), Quinault R. between Enchanted Valley & 3 mi. S of O'Neil Creek Shelter, *G. B. & R. P. Rossbach* 470 (CAS, DS, RM, WTU), Hoh R., near Jackson Guard Station, *J. E. Schwartz* 11A (WTU), Seattle, *L. Benson* 1486 (DS, POM), *A. Eastwood* 9603 (CAS), *S. M. Zeller in 1910* (MIN, MO), above Embro, *I. C. Otis* 739 (CAS, WS), Lake Washington, *T. E. Savage et al. in 1898* (IA, MIN), E side of Lake Washington, *J. H. Thomas* 5744 (DS), S Seattle, *J. W. Thompson* 5179 (DS, MIN, WTU); KITSAP COUNTY, 12 mi. W of Bremerton, *W. J. Eyerdam* 1647 (DAO, ID, WS, WTU), Seabeck, *L. A. Dillon* 484 (OSC, WS); KITTITAS COUNTY, Mt. Stuart, *A. D. E. Elmer* 1187 (MIN, US); KLUCKITAT COUNTY, Bingen Mts., Bingen, *W. N. Suksdorf* 5667 (WS), Klickitat R., *W. N. Suksdorf in 1886* (WS), Trout Lake, *W. N. Suksdorf in 1882* (WS), near spring in woods, *W. N. Suksdorf in 1885* (BH, CAN, MO, US, WS), Falcon Valley, *W. N. Suksdorf* 379 (WS); LEWIS COUNTY, Hogman, *F. Lamb* 1136 (NY, PH), clearing near Cripus R., *Mrs. M. E. Jones in 1941* (DS); MASON COUNTY, Skokomish Valley, *T. Kincaid in 1892* (WS), Lilliwap Falls on W side of Hood Canal, *F. Meyer* 507 (MO, WTU), near Wagonwheel Lake above Staircase Lodge, *P. A. Munz* 11491 (CAS, DS, UC, WS); OKANOGAN COUNTY, Okanogan Forest, *W. W. Eggleston* 13526 (US), 1 mi. N of Conconully, *A. N. Steward in 1919* (OSC), near Conconully, near summit of Muckamuck Lookout, *R. Bigelow* 132 (DS, GH, MO, WTU), Granite Mountain Trail, Twin Firs Camp, *C. B. Fiker* 292 (WS), Eight Mile Creek, Methow R., *J. W. Hungate in 1955* (WS), Republic, Sweat Creek, *J. W. Hungate* 34 (WS), Wenatchee Valley, Peshastin, *J. Sandberg & J. Leiberg* 506 (BH, CAS, GH, ILL, MO, NY, ORE, POM, UC, US, WS), Chelan National Forest, valley of War Creek, *H. St. John et al.* 3707 (WS); PACIFIC COUNTY, 2 mi. SW of Raymond, *D. Hedrick & F. Clifton* 142 (ALTA, CM, MO, POM, WS); PEND OREILLE COUNTY, Sec. 34, T39N, Sullivan Creek, *E. F. Layser* 232 (WS); PIERCE COUNTY, Mt. Ranier National Park, Hansen Camp, *L. R. Abrams* 9220 (DS, MO, POM, RM), Mt. Ranier, Longmire, *A. Lindsay* 4587 (NA, UTC), Mt. Ranier, Nisqually Glacier, *H. Cowles* 801 (MO), Ft. Lewis, *D. Keil* 2159-c (ASU), White River to Summerland, *P. H. Raven* 8695 (CAS), La Grande, *K. M. Wiegand* 1745 (CU), Sumner, Elhi Hill,

*C. Grainger* in 1910 (WTU); SAN JUAN COUNTY, San Juan Islands, Mt. Constitution, *S. M. & E. B. Zeller* 906 (MIN, MO, NY), Friday Harbor, *S. M. & E. B. Zeller* 905 (CM, GH), Trout Lake, *M. E. Peck* 13072 (WS); SKAGIT COUNTY, Pleasant Ridge, *H. Mason* 3809 (POM, UC); SKAMANIA COUNTY, Columbia National Forest, Panther Creek Road below bridge, *W. Bullard* 5832 (NA), Cape Horn, *W. N. Suksdorf* in 1894 (WS); SNOHOMISH COUNTY, Mt. Dickerman, *J. W. Thompson* 8805 (DS, MIN, NY, US, WTU), 10 mi. N of Seattle, *W. Eyerdam* in 1931 (UC), N slope of Mt. Pilchuck, *J. W. Thompson* in 1952 (RM, UT), Cascade Mts., Big Four Inn, *J. W. Thompson* 14701 (ALTA, COLO, DS, GH, MICH, MO, NY, OKLA, RSA, UBC, UC, W, WTU), Marysville, *J. M. Grant* in 1930 (KYO, UC), Edmonds, *G. Hoppe* in 1934 (SMU), Silverton, *Mrs. L. A. Rouck* 76 (WS), ca. 2 mi. SSE of Verlot, *G. Douglas* 527 (ALTA), Perry Creek Trail on S Fork Stillaquamish R., *L. K. Henry* in 1969 (CM), Snoqualmie National Forest, *E. Purer* 7718 (MO); Spokane County, Hangman Creek, *W. N. Suksdorf* in 1889 (WS), Mt. Spokane ("Mt Carleton"), *F. O. Kreager* 201 (GH, MIN, MT, NY, UC, US, UTC, WS, WTU), Mt. Kit Carson, *R. Sprague* 691 (WS), canyon above Bonnie Lake, *H. St. John et al.* 3291 (WS), E of Spokane, NE end of Spokane Lake, *O. E. & G. K. Jennings* 8626 (CM); STEVENS COUNTY, 10 mi. W of Chewelah, *R. Sprague* 692 (WS), heart of Huckleberry Mts., Chamakane R., *T. Large* 3 (WS); THURSTON COUNTY, ca. 5 mi. W of Olympia, *F. Meyer* 1581 (BH, GH, ISC, MIN, MO, NCSC, UC, UTC, WIS), Olympia, *E. C. Townsend* in 1904 (MO, UC, WS); WAHIAKUM COUNTY, Alochaman R., *H. St. John* 8764 (WS); WALLA WALLA COUNTY, Waitsburg, *R. Horner* R110 (GH), 2 mi. S of Walla Walla, *Hitchcock & Muhlick* 8281 (BH, CAN, CAS, DS, GH, IDS, ISC, MO, NY, PH, RM, TRT, UC, UTC, WS, WTU), Blue Mts., *C. Piper* 2409 (POM, WS); WHATCOM COUNTY, Mt. Hermann, *J. W. Thompson* 5691 (DS, GH, MIN, WTU), Mt. Baker National Forest, Goodell Creek, *W. C. Muenscher* 9953 (CU), Northwood, *W. C. Muenscher* 5057 (CU, GH, MO), Northwood Swamp, *W. C. Muenscher* 8269 (CU, UC, US), Forest Grove, *W. C. & M. W. Muenscher* 5474 (BH, CU), Mt. Baker region, Bagley Lake, *J. W. Thompson* 5377 (DS, WTU), Bellingham, *E. Hardin* 898 (WS), Gooseberry Point, *W. C. & M. W. Muenscher* 5981 (CU, MIN), Twin Lakes, Winchester Mt., *H. St. John* 9032 (WS), Fairhaven, *W. N. Suksdorf* (WS), Mt. Baker National Forest, Glacier Creek, *W. C. Muenscher* 8268 (CU, PH), Goshen, *W. C. & M. W. Muenscher* 5475 (BH, CU, GH); YAKIMA COUNTY, Mt. Adams, Seggenbach, *W. N. Suksdorf* 8288 (BH, WS), Yakima region, *T. Brandege* 502 (MO). WYOMING: CARBON COUNTY, Ferris Mts., *E. Nelson* 4955 (CM, CU, NY, POM, RM, US); CROOK COUNTY, ca. 10 mi. N of Sundance, Bear Lodge Range, *C. L. & M. W. Porter* 9099 (DS, MIN, RM, SASK, TEX, UC, WIS, WTU); NATRONA COUNTY, Casper Mt. area, Garden Creek Falls, *F. X. Jozwik* 174 (RM, SASK); PARK COUNTY, Yellowstone National Park, SW shore of Flat Mt. Arm of Yellowstone Lake, *L. Anderson* 1233 (UTC); SHERIDEN COUNTY, Lions Den, *V. Willets* 259 (RM); TETON COUNTY, Targhee National Forest, S Teton Canyon near Devil's Staircase, *L. Anderson* 602 (CAS, GH, OSC, RM, UC, UTC, WS, WTU), Grand Teton National Park, near junction of Death Canyon & Phelps Lake, *R. J. & R. W. Shaw* 1597 (UTC), Death Canyon, *H. V. Truman* 54392 (RM), summit of Teton Pass, *E. D. Merrill & E. N. Wilcox* 1180 (GH, RM, US), Teton Mts., *A. & E. Nelson* 6493 (BRY, CM, CU, DS, GH, ILL, ISC, KSC, MIN, MO, NEB, NMU, POM, RM, US).

*Circaea alpina* subsp. *pacifica* is recognized by having subentire leaves with usually rounded bases, a firm stem bearing at least a few recurved hairs (at least on the upper internode or in the nodal areas) and glandular pubescent raceme axes. Large plants closely resemble *C. lutetiana* in habit and several specimens from the Rocky Mountains have been misidentified as that species. However, in position and size of the flowers and in the fruits *C. alpina* subsp. *pacifica* is unmistakable. The flowers are held on erect or ascending pedicels and open before elongation of the raceme axis as in *C. alpina* subsp. *alpina*, *imaicola*, and *micrantha*.

In some ways the situation in *C. alpina* subsp. *pacifica* and *caulescens* is homologous to that found in other groups of plants disjunct between western North America and eastern Asia. These two subspecies have relatively thick pubescent stems and are more robust than *C. alpina* subsp. *alpina*, with which they both come in contact, but the differences in the position of flowers at anthesis, pubescence of the raceme axis, and texture and tothing of the leaves tend to rule out the possibility that one was derived from the other. It seems more likely that *C. alpina* subsp. *caulescens* and *pacifica* may represent an example of convergent evolution in similar but widely separated habitats.

Two characters that have been used in the past to separate *C. alpina* subsp. *pacifica* from subsp. *alpina* have proved to be nearly useless. Reddened nodes, while not common in *C. alpina* subsp. *pacifica* do occur in that entity and, although many plants of subsp. *alpina* do have reddened nodes, a large majority do not. Those plants of *C. alpina* subsp. *alpina* that do have reddened nodes are usually from more exposed habitats, woodland plants being entirely green. The absence of minute bracteoles have been used as a diagnostic character for recognizing *C. alpina* subsp. *pacifica* since Ascherson and Magnus (1871) first described the plants. This character is unreliable, many plants having bracteoles beneath at least a few of the pedicels of a raceme.

**7e. *Circaea alpina* L. subsp. *alpina*.—FIG. 24.**

- Circaea minima* L., Mant. 2: 316. 1771. As stated by H. E. Richter, Syst. Veg. 2: 25, Index, p. 47. 1835, this is undoubtedly an error for *C. alpina* L.  
*Circaea minima* Lam., Fl. Fr. 3: 473. 1778. Nom. subs. *C. alpina* L. in syn.  
*Circaea decumbens* Gilib., Fl. Lituan. 2: 127. 1782.  
*Circaea alpina* L. var. *intermedia* Willd., Sp. Pl. 1: 54. 1797. TYPE: At base of mountains in the cold part of Europe.  
*Circaea racemosa* Hull, Br. Fl. 6. 1799. Pro parte nom. subs., *C. alpina* L. and *C. lutetiana* L. in syn.  
*Circaea racemosa* Hull var. *alpina* (L.) Hull, Br. Fl. 7. 1799.  
*Circaea alpina* L.  $\alpha$  *minor* Schrad., Fl. Germ. 1: 204. 1806.  
*Circaea cordifolia* Stokes, Bot. Mat. Med. 1: 26. 1812. Nom. subs., *C. alpina* L. in syn.  
*Circaea alpina* L. forma *composita* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.  
*Circaea alpina* L. forma *ramosa* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.  
*Circaea alpina* L. forma *simplicissima* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.  
*Circaea lutetiana* L. var. *alpina* (L.) Torr., Rep. Bot. Dept. Surv. N.Y. Assembly 50: 136. 1841.  
*Circaea alpina* L.  $\alpha$  *fertilis* Döll, Rheinische Fl. 746. 1843.  
*Ocimastrum minimum* Rupr., Fl. Ingr. 367. 1860. Nom. subs., *C. alpina* L. in syn.  
*Circaea lutetiana* L. var. *alpestris* Schur, Enum. Pl. Transs. 214. 1866. TYPE: In moss hummocks in the fir region of the Arpas, 5,000 ft, July.  
*Regmus alpinus* (L.) Dulac, Fl. Hautes Pyr. 328. 1867. Nom. illegit.  
*Circaea lutetiana* L. subsp. *alpina* (L.) H. Lév., Monde des Pl. 7: 71. 1898.  
*Carlostephania minor* Bubani, Fl. Pyrenaea 2: 660. 1900. Nom. illegit.  
*Circaea lutetiana* L. race *alpina* (L.) H. Lév., Bull. Acad. Int. Geogr. Bot. 22: 220. 1912.  
*Circaea pacifica* Asch. & Magnus forma *dentata* H. Lév., Bull. Acad. Int. Geogr. Bot. 22: 222. 1912. "Idaho, Utah, Colorado." No specimens cited.  
*Circaea alpina* L. var. *aleutica* Nieuwl., Amer. Midland Naturalist 3: 184. 1914. TYPE: United States, Alaska, Spacious Bay, 16 July 1895, *M. W. Gorman* 199 (US, holotype; NY, isotype).  
*Circaea caulescens* (Komarov) Nakai ex Hara var. *rosulata* Hara, J. Jap. Bot. 10: 591. 1934. TYPE: U.S.S.R., Sakhalin, Tonnai-cho, August 1906, *G. Nakahara* (TI, holotype).  
*Circaea caulescens* (Komarov) Nakai ex Hara var. *glabra* Hara, J. Jap. Bot. 10: 590. 1934. TYPE: Japan, Honshu, Prefecture Nagano (Prov. Shinano), Mt. Yatsuga-dake, 19 August 1902, *Y. Yabe* (TI, holotype).  
*Circaea caulescens* (Komarov) Nakai ex Hara forma *ramosissima* Hara, J. Jap. Bot. 10: 591. 1934. TYPE: Japan, Shikoku, Prefecture Ehime (Prov. Iyo), Mt. Ishidzuchi, 9 August 1898, *R. Yatabe?* (TI, holotype).

Plants (0.3–)0.5–2.5(–3) dm tall, totally glabrous except for minute cilia along the leaf margin, sometimes on the petiole and sometimes also with soft, short glandular hairs on the axis of the inflorescence. The stem and petioles soft and somewhat succulent, terete, flattened in pressing and then appearing winged. Stem green or occasionally the nodes purple, rarely the entire stem purple in plants of exposed habitats. Leaves pale green, translucent; those near the summit of the stem the largest, 1.5–5.5(–7.5) cm long, 1.5–4.5(–5.5) cm wide, very abruptly reduced in size upward to the base of the inflorescence and then bractlike,



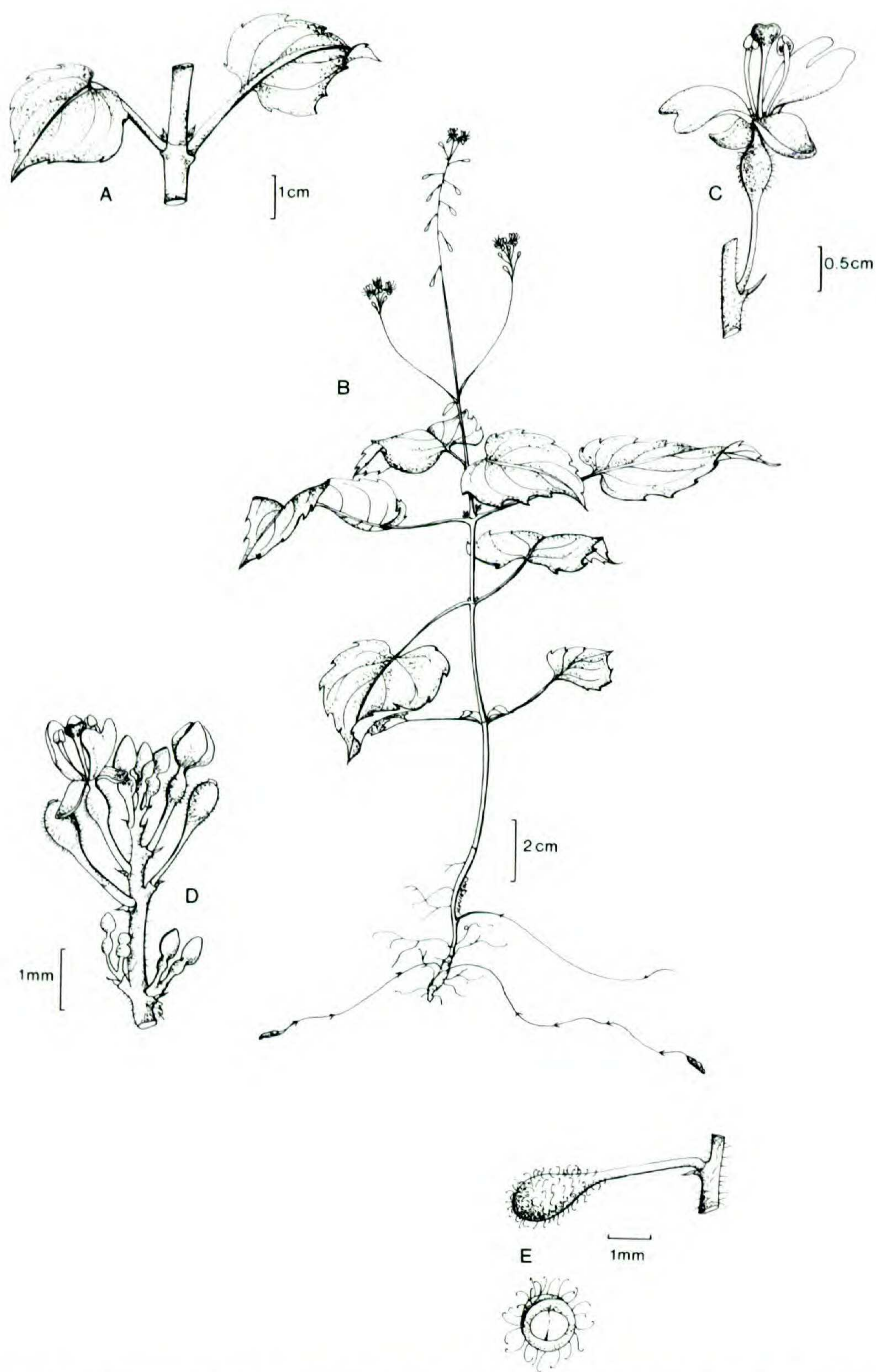


FIGURE 24. *Circaea alpina* L. subsp. *alpina*.—A. Node of upper stem.—B. Habit.—C. Flower.—D. Young inflorescence.—E. Fruit. From Boufford 18803 (KYO, MO).

gradually to abruptly reduced downward, sometimes clustered near the summit of the stem and then appearing somewhat whorled. Leaves ovate to very broadly so, rarely almost circular in outline, short acuminate to acute at the apex, cordate to subcordate, less commonly truncate or rounded at the base, conspicuously dentate, glabrous except for falcate cilia, 0.1–0.2 mm long along the margins, rarely with a few short soft, falcate cilia ca. 0.1 mm long on the upper surface

near the petiole. Petiole 0.3–3(–4) cm long, semi-terete in life, flattened and appearing winged in herbarium specimens; glabrous or sparsely pubescent in lines along the upper surface with short, upwardly curved, falcate hairs 0.1–0.2 mm long; with, or occasionally without, reduced branches arising in the axils. Inflorescence glabrous to densely pubescent with short, capitate and clavate-tipped glandular hairs 0.1–0.2 mm long; terminal on the main stem and upper axillary branches, or, in plants of exposed habitats, at the tips of axillary branches arising from near the base of the stem. The inflorescence simple or more commonly, with alternate or opposite lateral racemes from the base, these subtended by reduced leaves or leaflike bracts. Flowering pedicels glabrous, 0.7–2.4 mm long, ascending or erect; the flowers opening before elongation of the raceme and clustered at the apex; with a setaceous bracteole, 0.1–0.4(–0.6) mm long, at the base. Fruiting pedicels 1.5–3.8(–4.5) mm long. Buds glabrous; from the summit of the ovary, 0.8–2.2(–2.5) mm long, 0.4–0.9(–1.3) mm thick, white, occasionally pink or purple at the apex or sometimes the buds entirely pink. Ovary 0.5–1.5 mm long, 0.3–0.6 mm thick at anthesis, clavate to narrowly so; pubescent, with soft, short, translucent, uncinuate hairs. Floral tube represented by a mere constriction to 0.5 mm long, 0.1–0.2 mm thick at the narrowest point, funnellform. Sepals 0.9–1.8(–2.2) mm long, 0.6–1.2 mm wide, white or pink, occasionally tinged with purple at the apex; oblong to ovate, sometimes broadly so, rounded to the obtuse or minutely mammiform apex. Petals 0.6–1.5(–1.9) mm long, 0.8–1.7 mm wide, most commonly longer than wide, white, obtriangular to obovate in outline; the apical notch 0.3–0.5(–0.7) mm deep,  $\frac{1}{4}$ – $\frac{1}{2}$  the length of the petal; the petal lobes rounded. Filaments 0.7–2 mm long; anthers 0.2–0.4 mm long, 0.2–0.3 mm thick. Style 1.1–2.1 mm long; stigma 0.1–0.3 mm tall, 0.15–0.5 mm thick. Mature fruit clavate, 2–2.5 mm long, 0.7–1.2 mm thick, the translucent, uncinuate hairs 0.2–0.4 mm long. Combined length of pedicel and mature fruit, (3.7–)4.3–6(–6.5) mm long. Gametic chromosome number,  $n = 11$ .

TYPE: Sheet 25-2 (LINN) "*alpina*" can be taken as the lectotype. The species is common in Sweden and Linnaeus doubtless knew it well.

Distribution (Figs. 25, 26): Moist to wet places and on moss-covered rocks and logs. Circumpolar in cool temperate and boreal forests between 30° and 65° N. Lat. but restricted to high elevations at lower latitudes. From near sea level to 2,500 m. Flowers, June to August, rarely into early September.

#### Representative specimens examined:

##### NORTH AMERICA

CANADA. ALBERTA: Marten Mt., E of Lesser Slave Lake, *L. Abele & W. Peterson 165* (ALTA); T75, R15, W4, 6 mi. E of junction May Tower Road & McMurry Hwy, *P. Achuff 1024* (ALTA); T84, R11, W4, mile 127 of McMurry Hwy, *P. Achuff 1026* (ALTA); ca. 100 mi. NW of Edmonton, 15 mi. SW of Swan Hills, *P. Achuff 1615* (ALTA); Jasper, Edson Dist., W of Lake Iosegun, *B. Boivin & J. Perron 12541* (DAO, GH, NY, SASK); Slave Lake Dist., near Assineau R., *A. Brinkman 4360* (CU, NY); Jasper, *H. H. Brown in 1933* (TRT); Bicke Lake, Big Island, *W. Cody & R. Gutteridge 7068* (ALTA, DAO, GH); SW end of Lake Athabasca, 10 km S of Mamawi Lake, *D. Dobbs & W. Frieson 328* (SASK); 25 mi. N of Swan Hills, *M. G. Dumais et al. 43* (ALTA); Hutch Lake, N of High Level, *M. G. Dumais et al. 94* (ALTA, DAO); NW of Edmonton on hwy 43, ca. 45 mi. W of Whitecourt, *M. G. Dumais et al. 327* (ALTA); SW end of Long Lake, in Provincial Park, *M. G. Dumais & C. Watson 1702* (ALTA, CAN, DAO); 85 mi. NE of Slave Lake, Wabasca on S tip of N Wabasca Lake, *M. G. Dumais & K. Anderson 3292* (ALTA); S shore of Cold Lake, French Bay on the Alberta-

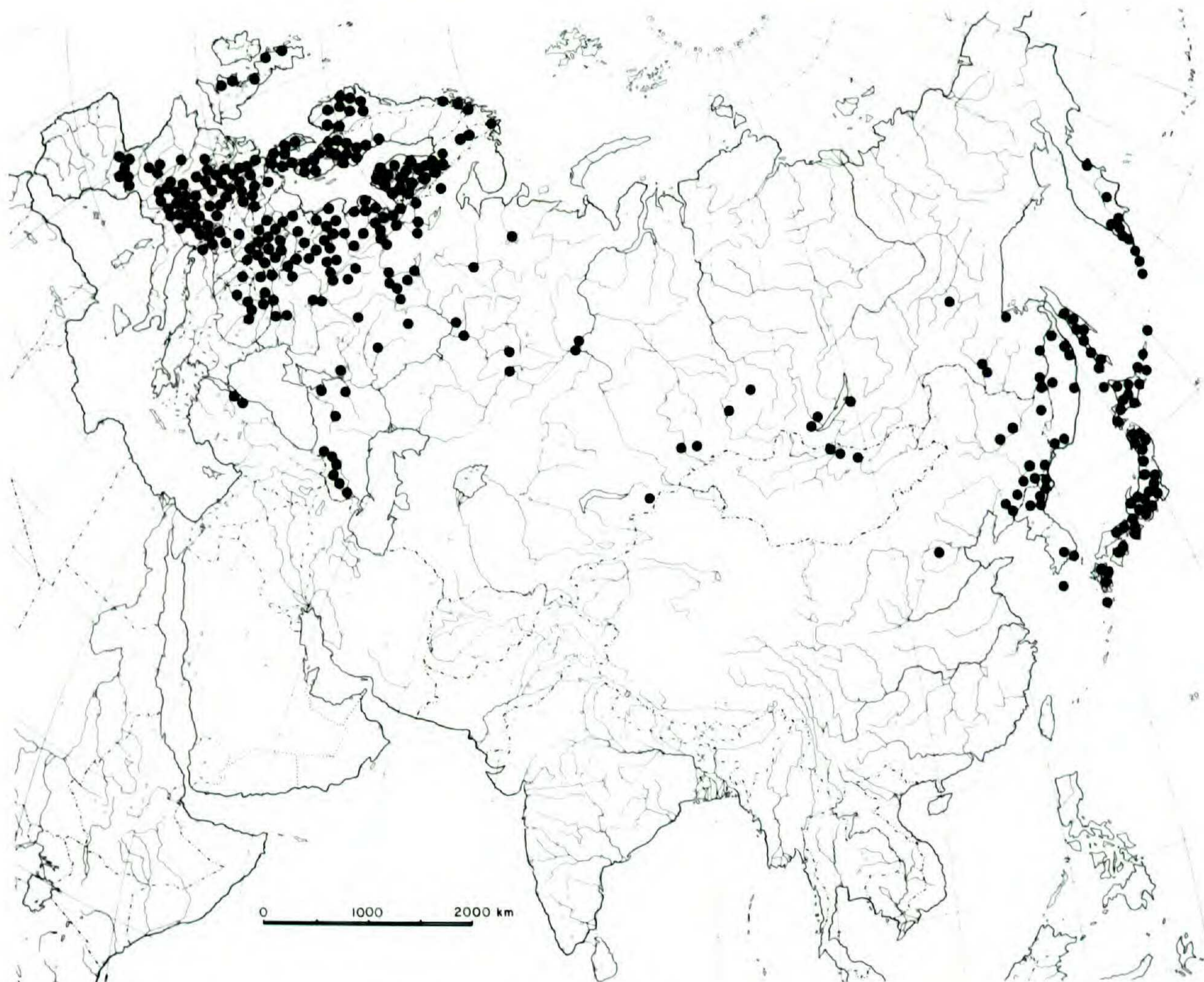


FIGURE 25. Distribution of *Circaea alpina* L. subsp. *alpina* in Eurasia.

Saskatchewan border, *M. G. Dumais & K. Anderson 3409* (ALTA, H, TRT); W side of Cold Lake on way to Marie Lake, *M. G. Dumais & K. Anderson 3507a* (ALTA); Big Island in Lake La Biche, *M. G. Dumais & K. Anderson 3637* (ALTA, CAN, TRT); Touchwood Lake, NE of Lake La Biche, *M. G. Dumais & K. Anderson 3696* (ALTA); ca. 2–3 mi. S of Fort Mackay, *R. Mackay, M. G. Dumais & K. Anderson 3877* (ALTA, CAN, DAO, TRT); 3 mi. E of Swan Hills, *M. G. Dumais & K. Anderson 4037* (ALTA); Waterton Lakes National Park, E slope of Mt. Crandall, *J. Kuijt & D. Dobbins 4434* (KESC); Castlemount, 8 mi. up W branch of Castlemount R., *M. O. Malte & W. R. Watson 2505* (CAN); W of Edmonton, near Winterburn, *W. C. McCalla E3555* (ALTA, UBC); W of Ellerslie, *E. H. Moss 1813* (ALTA); Edmonton, *E. H. Moss in 1944* (ALTA); Lesser Slave Lake, Faust, *E. H. Moss 6214* (ALTA); Lesser Slave Lake, Dog Island, *E. H. Moss 7919* (ALTA); Lesser Slave Lake, Widewater, *E. H. Moss 8268* (ALTA, DAO); Swan Hills, 25 mi. N of town, *J. G. Packer et al. 43* (DAO); vicinity of Fort McMurray, *H. Raup 7107* (CAN, GH, NY); Long Lake Provincial Park, *P. Scott & M. Dumais 1678* (CM, KYO, MHA, MO); 8 mi. W & 10 mi. N of Lacombe, *A. Sweet 10* (UAC); Fort Saskatchewan, *G. H. Turner 73* (GH); E of Pigeon Lake, near Mulhurst, *G. H. Turner 5029* (DAO); 55 mi. SW of Edmonton, near Mulhurst, *G. H. Turner 5029* (RSA); S of Battle Lake, 10 mi. SW of Ma-Me-O Beach on Pigeon Lake, *G. H. Turner 5946* (ALTA, CAN, DAO, MTJB); 6 mi. NE of Fort Saskatchewan, *G. H. Turner 739* (ALTA, DAO); Strathcona, *M. Willing in 1900* (SASK). BRITISH COLUMBIA: S Caribou Mts., Wells Gray Provincial Park, Murtle Lake, *L. & T. Ahti 6758* (H, V); Mara, *J. R. Anderson in 1904* (V); Comox Dist., Skeena, *J. R. Anderson in 1910* (WS); near mi. 284 of Alaska Hwy, *R. Annas in 1971* (UBC); Liard Hot Springs, mi. 496.5 of Alaska Hwy, *G. W. Argus & W. Chunys 5000* (CAN); Prince George Dist., Crooked R. below Davis Lake, *A. Auclair & S. Eis in 1963* (DAO); ca. 47 mi. N of Prince George, *A. Auclair 493* (DAO, MTMG, TRT); Summit Lake, ca. 25 mi. N of Prince George, *A. Auclair 519* (CAN, DAO, MTMG, TRT); Prince George Dist., 10 mi. N of Quesnel, *A. Auclair & S. Eis in 1963* (DAO); Wells area, Antler Creek, *K. Beamish et al. 8804* (UBC); 12 mi. E of Slokan Lake, Wilson Creek, *K. I. Beamish et al. 750249* (UBC); Chilcotin, *C. E. Beil 68-08-34* (UBC); Mabel Lake, *M. Bell in 1958* (UBC);

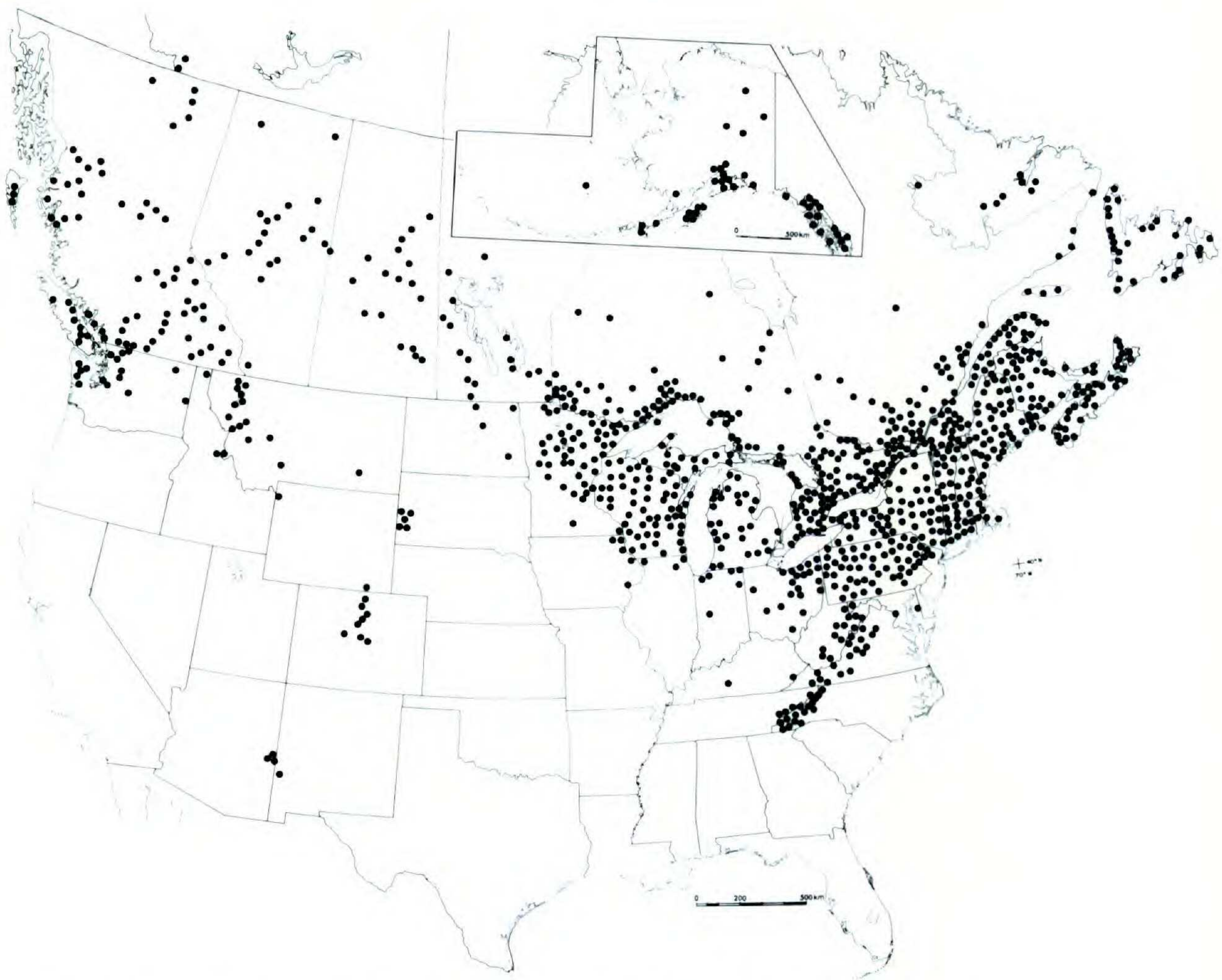


FIGURE 26. Distribution of *Circaea alpina* L. subsp. *alpina* in North America.

Othello, T. C. Brayshaw 49218 (UBC); Ft. Nelson, V. C. Brink in 1943 (UBC); Skeena Co., Prince Rupert, H. H. Brown, in 1933 (DAO, TRT); 6 mi. SE of Nakusp on road to Denver, J. A. Calder & D. Savile 9981 (NY, UBC, V); SE end of Lakelse, 11 mi. S of Terrace, J. A. Calder et al. 13044 (CAS, DAO, GH, US); 3 mi. SW of Kwinitsa, J. A. Calder et al. 13099 (COLO, DAO, UC); 16 mi. NNE of Barkerville along road to Bowron Lake, J. A. Calder et al. 14310 (DAO, WTU); 6 mi. SW of Legate Creek–Skeena R. junction along road between Terrace & New Hazelton, J. A. Calder et al. 14808 (DAO, UBC); from Williams Lake to Anahim Lake, J. A. Calder et al. 17963 (DAO); 4.5 mi. E of Bella Coola on road to Anahim Lake, J. A. Calder et al. 18510 (DAO, DS, UC); Martin Creek at mi. 242.5, Alaska Hwy, J. A. Calder & I. Kukkonen 27137 (DAO, DS, MAK); Alaska Hwy, Liard Hot Springs, J. A. Calder & I. Kukkonen 27557 (DAO); Queen Charlotte Islands, ca. 8 mi. SSW of Juskatla, J. A. Calder & R. Taylor 35476 (DAO); 16 mi. S of Juskatla, J. A. Calder & R. Taylor 35496 (DAO); Graham Island, N end of Long Aram, J. A. Calder & R. Taylor 35968 (DAO); Queen Charlotte Islands, near W end of Mosquito Lake, J. A. Calder & R. Taylor 36710 (ACAD, B, COLO, DAO, DS, GH, H, MAK, NCU, NY, OSC, RSA, SASK, TRT, TUR, UC, W, WS, WTU); Graham Island, W of Queen Charlotte City, J. A. Calder & R. Taylor (DAO); Pine R., near West Pine Bridge, D. H. Calverley 224 (V); Mt. Robson Park, W entrance, C. C. Chuang 75191 (V); Jordan Creek near Revelstoke, R. E. Cleland in 1921 (IND); Liard Hot Springs, 196 mi. NW of Fort Nelson, R. F. Daubenmire 5152 (WS); Vancouver, Point Grey, J. Davidson in 1911 (UBC); Brackendale, J. Davidson in 1912 (UBC); Wigwam River, Kootanie Valley, Dawson in 1883 (CAN); 5 mi. up Tzoonie R., R. B. Dickens 131 (UBC); Canim Lake, Cariboo, J. W. Eastham in 1946 (UBC); Fernie, Fairy Creek, J. W. Eastham in 1947 (DAO, UBC, V); Glacier National Park, Glacier, E. Farr in 1904 (PENN); Marysville, F. Fodor 14 (UBC); Revelstoke, F. Fyles in 1914 (DAO); Langley Prairie, H. Groh in 1930 (DAO); Glacier National Park, Bald Mt. Trail to Grizzly Creek, E. Haber & M. J. Shchepanek 1765 (CAN); Cathedral Park, junction of Ewart Creek and Ashnola R., R. Hainault 7770 (UBC, V); Skagit Valley, Whitworth Ranch, G. A. Hardy 20421 (V); Manning Park, G. A. Hardy 21726 (V); Kooteway Dist., Crawford Bay, L. C. Harrison s.n. (WS); near Kitsault Glacier, Alice

Arm, *L. Harrison in 1949* (UBC); near Vancouver, *J. K. Henry 4242* (RM); Louise, *P. P. Henson in 1932* (DAO); Georgetown, *A. L. Hill in 1910* (UBC); Kinbasket Lake, *W. B. Johnstone in 1952* (V); Cultus Lake, *V. J. Krajina in 1949* (UBC) Cheam Lake, *V. J. Krajina 594* (DAO, GH, UBC, WIN); Vancouver Island, Nanaimo R. Valley, *V. J. Krajina et al. 4614* (DAO, GH, UBC); Vancouver Island, MacMillan Park, *V. J. Krajina et al. 5340* (DAO); ca. 10 mi. NNW of McGregor, *V. J. Krajina & J. Pojar in 1974* (UBC); 30 mi. SE of Purden Lake, Slim Creek, *V. J. Krajina et al. in 1974* (UBC); Hazelton, Vesterlund, *V. Kujala & A. Cajander in 1931* (H); Vancouver Island, Cowichan Lake, *V. Kujala & A. Cajander in 1931* (H); King Island, Port John, *H. M. Laing 585* (CAN); Bella Coola, Hagensborg, *H. M. Laing 586* (CAN); Agassiz, below Mt. Cheam, *G. F. Ledingham 49-498* (DAO); near Cheam R., *G. F. Ledingham & Brink 49-498* (USAS); Lower Fraser R., 49°N. Lat., *Dr. Lyall in 1859* (GH); Selkirk, N Fork Illecillawaet R., *J. Macmillan in 1904* (CM, NEB, PH, US); Cascade Mts., Yale, *J. Macoun 463* (MTMG); Chilliwack Valley, *J. M. Macoun 44410* (CAN, CAS, POM, WS); Agassiz, *M. O. Malte in 1912* (CAN); Bella Coola, *B. McAvoy 84* (UBC), *T. T. McCabe 1417* (UC); Fitzhugh Sound, Koeye R., *T. T. McCabe 3100* (UC); Swanson Bay, Graham Reach, *T. T. McCabe 3642* (UC); mainland opposite Kaun Island, *T. T. McCabe 4315* (UC); 8 mi. N of Revelstoke, Silvertip Falls, *T. T. McCabe 5453* (UC); Don Peninsula, Neekis R., *T. T. McCabe 7383* (UC); New Hazelton, *T. T. McCabe 8222* (UC, WTU); W of Vanderhoof, *A. P. McLaughlin 53* (V); Kitimat, *Mrs. G. Mendel 175* (V); 10 mi. NE of Terrace, Skeena Valley, *Mrs. G. Mendel 176* (V); Napieipuo R. Valley NE of 4th Lake, *D. Mueller-Dombois 98-5* (V); Mt. Waddington, Franklin Valley, *Mrs. D. Munday 9776* (V); Bouchie Lake, *J. A. Munro 241* (CAN); Crawford Bay, mouth of Crawford Creek, *H. Murray 16183* (DAO, UBC); Quesnal Dam, *W. A. Newcombe 405* (UBC, V); Yoe Island, Eilerslie Channel, *W. A. Newcombe in 1922* (V); 33 mi. N of Revelstoke near Mars Creek, *R. T. Ogilvie in 1953* (UBC); Aiyansh, *R. J. Pilfrey in 1960* (DAO); Klesilka R. near junction with Maselpalik Creek, *J. Pinder-Moss & P. Hamlyn 1168* (UBC); Liard Hot Springs, *A. & R. Porsild 22085* (CAN); vicinity of mouth of Quartz Creek, *H. M. Raup & E. C. Abbe 4204* (CAN, GH, MIN, MT, NY, POM); near lower crossing of Liard R., *H. M. Raup & D. S. Correll 10888* (A, CAN, UBC); Mckinley Lake, 20 mi. SE of Horsefly, *S. Russell 8-M* (V); Graham Island, Blackwater Creek, Juskatta area, *D. B. O. Savile 3527* (DAO); Mt. Robson, *E. Scammon 3303* (GH); Front Lake City, *E. Scheuber in 1904* (US); N of Terrace, W side of Kitsumgallum Valley, *R. L. Schmidt 37* (UBC); Selkirk, near Nelson, *C. H. Shaw 665* (CM, COLO, GH, NEB, NY, PH, US); Selkirk, woods by Goldstream, *C. H. Shaw 1085* (CM, COLO, GH, GRI, MO, NEB, NY, PENN, PH, US); Selkirk, near mouth of Downie Creek, *C. H. Shaw 1120* (CM, COLO, GH, GRI, MO, NEB, NY, PENN, PH, US); Mt. Revelstoke National Park, W Woolsey Creek, *J. H. Soper & M. J. Shchepanek 12793* (CAN, V); Chilliwack Valley, *J. Sprenborough 79405* (CM); Vancouver Island, Renfrew Dist., *C. Rosendahl 834* (CAN, COLO, DS, MIN, MO, NEB, NY, RM); Horseshoe Valley, Stillwater, *G. Stanley B222* (V); Bear Creek, Penticton, *M. Stonor in 1937* (UBC); foot of Mt. Robeson along rte 16, *G. B. Straley 1621* (MO); along rte 24, ca. 6 mi. W of Little Fort, *G. B. Straley 1649* (MO); 20 mi. E of Revelstoke, Illecillewaet R. on border of Glacier National Park, *A. F. Szczawinski in 1964* (DAO, UBC, V); 2 mi. W of Brisco, *R. L. Taylor & D. H. Ferguson 2530* (DAO, DS); 4.5 mi WSW of Wycliffe, *R. L. Taylor & D. H. Ferguson 2636* (DAO); 4.3 mi. S of Grindrod on hwy 97E, *R. L. Taylor & G. Staudt 4314* (DAO, NY); Victoria Island, Markale, Kyuquot, *T. M. C. Taylor & A. F. Szczawinski 259* (UBC, V); Stanley, *T. M. C. Taylor 9055* (UBC); Mt. Waddington, *W. Taylor in 1937* (UBC); 100 mi. N of Golden, *W. A. Weber 2528* (CAN, COLO, GH, NY, POM, UBC, UC, V, WS, WTU); Armstrong, Okanagan, *E. Wilson 229* (UBC). LABRADOR: Foot of Big Hill portage, Hamilton R., *M. T. Doult 3243a* (CM); Straits of Belle Isle, Forteau, *M. L. Fernald & K. M. Wiegand 3747* (CU, GH); Goose Bay, *J. M. Gillett & W. I. Findlay 5547* (DAO, MIN, RM, UBC, WS, WTU); Traversspine R., *J. M. Gillett & W. I. Findlay 5610* (ACAD, DAO, GH, MT, NY, TRT, US, W); Kenemich R., *J. M. Gillett & I. McKay 5814* (DAO); Hamilton R., Twin Falls area, *I. Hustich & P. Kallio 139a* (TUR); Northwest River area, Salt Pond, *I. Hustich & P. Kallio 476* (TUR); Schefferville area, Knob Lake, *I. Hustich & P. Kallio 833* (TUR); Goose Bay, *W. Schofield 687* (DAO); Capstan Island, *A. C. Waghorne in 1893* (KSC, MIN, US). MANITOBA: Otterburne, to the E, *Fr. J. P. Bernard 58/386* (MT); MacDonald Dist., 3 mi. SW of Shilo, *B. Boivin et al. 13199* (DAO, GH, NY, WIN); Max Lake, Turtle Mts., *M. v. Buskirk M-9* (WIN); Lake of Woods, *G. Dawson in 1873* (MTMG, TRT); Sandy Hook, *M. G. Dudley in 1929* (WIN); Swan R., *H. Groh in 1922* (WIN); Gimli, *V. W. Jackson in 1923* (WIN); Porcupine Provincial Forest, *G. M. Keleher 71-25* (WIN); The Pas, Lake Atibameg area, 25 mi. N, *W. Krivda 1523* (UBC); The Pas, Prechart's woods, *W. Krivda 66-575* (MAK); The Pas, Rall's Island, *W. Krivda 72-571* (WIN); Pinawa, F. I. G. Area, Whiteshell Nuclear Research Establishment, *R. E. Longton in 1977* (WIN); NW of Grassy Narrows, S19, T24, R5E, *A. & D. Löve 5492* (DAO, NDA, US, WIN); Camp Morton, S9, T20, R4E, *A. & D. Löve 5708* (CAN, DAO, MTJB, SASK, US, WIN); Shoal Lake, *C. W. Lowe in 1921* (WIN); Dog-head, Lake Winnipeg, *J. M. Macoun in 1884* (CAN); Brandon Dist., Brandon, *H. Marshall 54* (DAO); Brokenhead, S35, T14, R7, *T. Mosquin in 1952* (DAO, WIN); Gilbert Plains, *J. L. Parker 2945* (WIN); Riding Mountain National Park, *J.*

Rowe in 1948 (WIN); Lake Winnipegosis, Nason Island, N of Whiteaves Point, Dawson Bay, *H. J. Scoggan* 4588 (CAN, UBC, WIN); Herb Lake, around village on Wekusko Lake, *H. J. Scoggan* 6476A (ALTA, CAN); Lake Winnipeg, Hecla Island, *H. J. Scoggan* 9136 (ALTA, CAN, GH, MIN, MT, WIN); Brandon, *G. A. Stevenson* 1506 (DAO, NDA). NEW BRUNSWICK: Sunbury Co., Acadia Forest Experiment Station, *G. C. C. in 1957* (UNB); Kings Co., Hampton, *A. Chadbourne in 1883* (GH); Campbellton, *R. Chalmers in 1877* (CAN); Kings Co., Quoddy Bay, Indian Island, *M. Chrysler* 6075 (GH); Quoddy Bay, Deer Island, *M. Chrysler* 6115 (GH); Northumberland Co., Bay du Vin, *P. Cox in 1908* (UNB); St. Andrews, *E. H. Craigie in 1914* (TRT); Carleton Co., Richmond Corner, *W. G. Dore & E. Gorham* 45857 (DAO, MT, NHA, US); Carleton Co., W of Woodstock, *W. G. Dore & E. Gorham* 45915 (DAO, MT); York Co., Oromocto R., *B. Ellis* 63-47 (UNB); Queens Co., Charlottetown, *M. L. Fernald et al.* 7838 (GH); St. Andrews, *J. Fowler in 1900* (US); Charlotte Co., Kent's Island, *H. Gleason* 89 (NY); Bay of Fundy, Kent's Island, *H. A. Gleason, Jr.* 14 (NY, WVA); Restigouche Co., Summit Depot, *R. H.* 735 (UNB); Fredericton, Odell Woods, *Hagmeier in 1958* (DAO, UNB); St. John, Lily Lake, *G. U. Hay* 207 (ACAD); Carleton Co., near Jackson Falls, *K. Heinste in 1965* (UNB); Charlotte Co., S Wolf Island, *A. R. Hodgdon & R. B. Pike* 18074 (NHA, UNB); Kings Co., Shediac Cape, Bateman's Pond, *F. Hubbard in 1914* (GH); Kings Co., Albert, *C. Knowlton in 1925* (GH); Fundy National Park, Point Wolfe R., *T. M. Lothian* 155 (DAO); St. Andrews, *M. O. Malte* 149/29 (UTC, WTU), *M. O. Malte* 192/29 (CAN); Bathurst & vicinity, *M. O. Malte* 648 (CAN, WTU); St. Leonard & vicinity, *M. O. Malte & W. R. Watson* 501 (CAN, WS, WTU); Blue Bell Mt., *M. O. Malte & W. R. Watson* 682 (CAN, WS); Sunbury Co., near Fredericton, *C. McKenney* 5,6-25 (BH, DAO, MIN, MONTU, MT, NA, NY); Balhurst, *L. Meehan in 1869* (MTMG); Grand Manan Island, N Head, *A. E. Perkins in 1935* (CU); Carlton Co., Tracey Mills, *H. G. Perry in 1910* (ACAD); St. Andrews, Biological Station, *H. G. Perry in 1913* (ACAD); 1 mi. SW of Tay Mills, *W. H. Poole* 296 (DAO); Carleton Co., Hartland, *P. R. Roberts* 60-257 (UNB); York Co., near Moose Lake, *P. R. Roberts & D. E. Drury* 63-1186 (ACAD, MT, UNB); Madawaska Co., rte 7, from Black Brook, *P. R. Roberts & D. E. Drury* 63-1718 (UNB); Victoria Co., Grand Falls, *P. R. Roberts & D. E. Drury* 63-1549 (DAO, UNB); Restigouche Co., States Lake, *P. R. Roberts & D. E. Drury* 63-1855 (UNB); Northumberland Co., Burnt Church R. at hwy bridge over #11, *P. R. Roberts & D. E. Drury* 63-2079 (DAO, UNB); Madawaska Co., road to Long Sett from Clair, *P. R. Roberts & N. Bateman* 64-3188 (DAO, UNB); Victoria Co., Wapskehegan R. at E Beaver Brook, *P. R. Roberts & N. Bateman* 64-3589 (CAN, UNB); Victoria Co., between dammed Long Lake & Mud Lake, *P. R. Roberts & N. Bateman* 64-3701 (DAO, UNB); Restigouche Co., Kedgwick R. at Mile Brook, *P. R. Roberts & N. Bateman* 64-3886A (UNB); Northumberland Co., 5 mi. W of Red Rock, *P. R. Roberts & B. Pugh* 65-1414 (UNB); Kent Co., 1.5 mi. S of S St. Nicholas, *P. R. Roberts & B. Pugh* 65-2332 (MT, UNB); Kent Co., 4 mi. N of Bass River Settlement, *P. R. Roberts & B. Pugh* 65-2426 (UNB); Restigouche Co., Tetagouche R. between Lower & Middle Tetagouche Lakes, *P. R. Roberts & B. Pugh* 65-5003 (UNB); Restigouche Co., Jacquet River Lake, *P. R. Roberts & B. Pugh* 65-5056 (UNB); Restigouche Co., Tetagouche R. headwaters, *P. R. Roberts & B. Pugh* 65-5099 (UNB); Gloucester Co., Tetagouche Falls, *P. R. Roberts & B. Pugh* 65-5236 (UNB); Restigouche Co., N Branch Charlo R., *P. R. Roberts & B. Pugh* 65-5510 (UNB); Restigouche Co., junction of Little Popelogan and SE Upsalquitch Rivers, *P. R. Roberts & B. Pugh* 65-5848 (UNB); Victoria Co., Moose Mt. Fire Tower, *P. R. Roberts & B. Pugh* 65-6191 (UNB); Restigouche Co., E end of Little Nictor Lake, *P. R. Roberts & B. Pugh* 65-6267 (UNB); St. John Co., Cape Spencer, *P. R. Roberts & B. Pugh* 65-6344 (UNB); Restigouche Co., Miner's Road along Portage Lake, *P. R. Roberts* 66-488 (UNB); York Co., Maple Grove, *P. R. Roberts* 66-673 (UNB); Charlotte Co., St. Andrews, *D. R. Sampson* 173 (MT); Fredericton, *H. J. Scoggan* 12816 (ACAD, CAN, MAK, W); ca. 25 mi. SW of Campbellton, Squaw Cap, *H. J. Scoggan* 13125 (CAN); Sussex, ca. 45 mi. SW of Moncton, *H. J. Scoggan* 13417 (ACAD, MAK, W); Restigouche Co., 8 mi. SW of Nictau Lake, *E. C. Smith & R. E. Clattenburg* 20037 (ACAD); York Co., 0.75 mi. W of Hanville, *E. C. Smith & J. M. Stanley* 23355 (ACAD); Restigouche Co., Summit Depot, *E. C. Smith et al.* 16235 (ACAD); Northumberland Co., Tabusintoc R., *E. C. Smith et al.* 16488 (ACAD); Campobello Island, *J. Smith* 767 (US); Fawcett Hill, *W. A. Squires & D. Christie in 1963* (DAO); woods S of The Whistle, Grand Manan, *C. A. & U. E. Weatherby, Pl. Exs. Grayanae* 1079 (ARIZ, B, BH, CAN, CAS, COLO, DAO, DS, GA, GH, IA, ILL, IND, ISC, KY, LL, LTU, MASS, MICH, MIN, MO, MONTU, MT, NA, NCSC, NCU, NHA, NY, NYS, OKL, OKLA, OSC, PAC, PENN, PH, POM, RM, SMU, TENN, TEX, TNS, TRT, UARK, UC, US, UTC, WIS, WS, WTU, WVA); Cape Breton Island, New Campbelltown, *D. White & C. Schuchert* 65 (US); York Co., near Scotch Lake, *without collector* 798 (UNB); Madawaska Co., 3rd Lake, Green R., *without collector in 1957* (UNB). NEWFOUNDLAND: Bay of Islands, *D. A. Atkinson in 1907* (CM); S of Gander, Gander Lakes, *I. Basset* 439 (DAO, MO, MT); 1 mi. SW of Cartyville, *I. Basset* 730 (DAO); Neddy Harbor, near Bonne Bay, *H. Bishop* 438 (CAN, GH); Western Brook Pond, *A. Bouchard & G. Hay* 72-372 (CAN); St. Paul's Inlet, *A. Bouchard & G. Hay* 72-373 (CAN); St. Barbe S Dist., Gros Morne National Park, Lobster Cove Head, *A. Bouchard & S. G.*

Hay 72-374 (MT); near Hawke Bay, *J. Donly* 49 (DAO); Bay of Islands, *E. H. Eames & C. C. Godfrey* 7054 (IND); Humber Arm Region, Birchy Cove (Curling), *M. L. Fernald & K. M. Wiegand* 3746 (CU, GH, NY, PH); Region of Ingornachoix Bay, Port Saunders, *M. L. Fernald & K. M. Wiegand* 3748 (CAN, CU, GH); S shore of Notre Dame Bay, Black Island, *M. L. Fernald & K. M. Wiegand* 5935 (GH, PH); W (S) Arm Bonne Bay, near Winterhouse Brook, *M. L. Fernald et al.* 1888 (GH, PENN, US); Straits of Belle Isle, Mistaken Cove, *M. L. Fernald et al.* 26844 (CU, GH, PH); Bay of Islands region, Mt. Moriah, *M. L. Fernald et al.* 26845 (CU, GH, NY, PH, US); 3 mi. SE of Argentina, *D. Grether* 7758 (DAO, WIS); La Poille Bay, Bay du Nord village, *A. Heyl* 116 (PH); Placentia East Co., Southern Harbor, *J. H. Himmelman* 109 (ACAD); Channel, *C. Howe & W. Lang* 888 (GH, NY); Conception Bay, near Topsail, *C. Howe & W. Lang* 1223 (GH, NY); Bonne Bay, above Woody Point, *R. Kimball* 117 (GH); near Frenchman's Cove, *K. K. Mackenzie* 10358 (GH, NY); Humber Dist., Big Falls, Upper Humber R., *D. Pimlot* 212 (MT, WIS); Flower's Cove, *M. Priest* in 1920 (GH); Manuels R., *B. L. Robinson & H. Schrenk* 6 (CAN, GH, MIN, MO, NY, PH, US); Doncette Brook, Tompkins, *A. E. Roland & E. C. Smith* 74 (ACAD); Humber Dist., Goose Arm, E of William Wheeler Point, *E. Rouleau* 137 (DAO, MT); Humber Dist., Steady Brook, *E. Rouleau* 762 (DAO, MT); Humber Dist., Grand Lake, Hinds Brook Falls, *E. Rouleau* 2257 (MT); Burin Dist., Main R., *E. Rouleau* 4213 (DAO, MT); Barbe Dist., 4 mi. N of Cow Head, Stanford or Slants R., *E. Rouleau* 4344 (MT); ca. 1 mi. S of Loon Bay, *E. Rouleau* 4863 (DAO, MT, US); St. Georges Dist., Mollichionneck Brook at the junction of Great Codrey R., *E. Rouleau* 6482 (MT); Fortune Bay-Hermitage Dist., Grand-le-Pierre, *E. Rouleau* 6820 (MT); Englee, *D. Savile* 2708 (DAO); St. Anthony, *D. Savile* 2931 (DAO); Port au Choix, *D. Savile* 3033 (DAO); Bonavista North, Alexander Bay, Thimble Cove, *A. Smith et al.* 220 (DAO); Lewisport, *J. Sornborger* in 1903 (GH); Cow Head, *H. J. Squires* 156 (ACAD); Salmonier, *R. Thaxter* in 1885 (GH); Coal R., *A. C. Waghorne* in 1896 (MO); Capstan Head, *A. Waghorne* in 1893 (NY); Straits of Belle Isle, Sacred Island, *K. M. Wiegand et al.* 28747 (CU, GH, PH); Placentia, Avalon Peninsula, *C. Williamson* 328 (NY, PENN, PH). NORTHWEST TERRITORIES: Mackenzie Dist., 8 mi. SW of Fort Liard, *W. J. Cody & K. W. Spicer* 11638 (MO, SASK, SMU, UBC); Mackenzie Dist., Big Island, 15 mi. N of Fort Liard, *W. J. Cody & K. W. Spicer* 11834 (ALTA, MAK, MICH, MIN, NY); Mackenzie Lowlands, Liard R. valley, *W. Jeffrey* 20 (CAN); Mackenzie Dist., Reed's Portage, Upper Embarras R., *H. Raup* 2843 (CAN, H, NY, UC, US). NOVA SCOTIA: Sandy Cove, *J. Adams* in 1937 (DAO); Cape Breton, Pleasant Bay, *L. H. & E. Z. Bailey* 593 (BH); Annapolis Co., North Mt., Granville, *E. Bartram & B. Long* 24216 (CAN, GH, PENN); Colchester Co., Folley, *R. C. Bean et al.* 22007 (GH); Colchester Co., Salmon R., Bible Hill, near Truro, *H. P. Bell et al.* in 1949 (DAL); Halifax Co., Kearney Lake, *H. P. Bell et al.* in 1949 (DAL); Queens Co., Port Mouton, *H. P. Bell et al.* 50226 (DAL); Colchester Co., Truro, *C. Bissell & C. Linder* 22006 (CAN, GH, PENN); Colchester Co., 3 mi. NW of Kemptown, *B. Brown* in 1972 (MTMG); Five Islands, R., *E. Chase* in 1960 (DAO); Antigonish, Frasers Mill, *H. L. Christie* 12365 (ACAD); Colchester Co., Central New Annan, *W. Cody* 21494 (DAO, MO); Shelburne Co., Bon Portage Island, Cranberry Swamp, *G. Demone* 23529A (ACAD); Pictou Co., near Scotsburn, Roger Hill, *W. G. Dore & E. Gorham* 45449 (ACAD, DAL, DAO, LL, MT); Kings Co., Hunting Point, *J. S. Erskine* in 1949 (DAL); Kings Co., E of White Rock dam, *J. S. & D. Erskine* 178 (ACAD); Annapolis Co., near Margaretsville, *J. S. & D. Erskine* 311 (ACAD); St. Paul Island, Little Lake, *J. S. Erskine* 53916 (DAO, MTJB); Yarmouth Co., Tusket Islands, Owl Head, *J. S. Erskine* 54-1378 (ACAD); Victoria Co., North River, *J. S. Erskine & P. Bentley* 56316 (DAO); Yarmouth Co., Mud Island, *J. S. Erskine* 56675 (ACAD); Cape Breton, Wycocomagh, Sky Mt., *D. Etheridge* 614 (UNB); Guysboro Co., Glenelg, *E. R. Faribault* 817 (MT); Cape Breton Highlands National Park, S Ingonish, *H. Ferguson* 1-4-43 (DAO, NY, WIS); Queens Co., near mouth of Broad R., *M. L. Fernald & C. Bissell* 22011 (GH, PENN); Queens Co., Keji National Park, W of Grafton Lake, *H. L. Forsyth* in 1972 (ACAD); Canso, *J. Fowler* in 1901 (UBC, UNB); Chezzetcook, *M. Forward* in 1930 (UBC); Digby Co., between Meteghan & Belliveau, *J. Gillett & J. Soper* 15705 (CAN); Digby Co., Brier Island, *D. P. Gordon* in 1972 (DAL); Cumberland Co., Soldier Brook, Refuge Cove, *M. J. Harvey* in 1978 (DAL); Halifax Co., White Island, *W. S. Hoar* in 1939 (TRT); near Digby, *C. Howe & W. Lang* 167, 259 (GH, NY); Pictou Co., near Pictou, *C. Howe & W. Lang* 509 (GH, NY); Annapolis Co., Karsdale, *J. W. Johnson* in 1962 (ACAD); Willowdale, *J. T. B. K.* in 1947 (UNB); Halifax Co., Lakeview, *H. M. King* in 1901 (DAL); Kings Co., Lakeville, *R. M. Lewis & E. Gorham* in 1944 (DAL); Kings Co., Canaan, *R. M. Lewis* 1627 (DAO); Annapolis Co., N of Middleton, North Mt., *B. Long* 22009 (GH, PH); Yarmouth Co., Beaver Lake, *B. Long & D. Linder* 22010 (CAN, GH, PH); Blomidon, *J. Macoun* 2010 (CAN); Cape Breton Island, Baddeck, *J. Macoun* 19127 (CAN, GH); Colchester Co., Salmon R. near Truro Agr. College, *S. Mason et al.* 197 (DAO); Halifax Co., Kearney's Lake, *J. W. McLellan* in 1937 (DAL); Cape Breton, *G. Nichols* 986 (GH); vicinity of Guysborough, *H. Osborn* in 1879 (DAO); Cumberland Co., Springhill Junction, *A. S. Pease & B. Long* 22005 (GH, PH); Hants Co., Five Mile R., *A. S. Pease & B. Long* 22008 (PH); St. Paul Island, Coggin Mt., *L. Perry & M. Roscoe* 292 (CAN, GH, MT, PH); Guysborough Co., West Cook's Cove, *N. G. Perry et al.* 10110 (ACAD); Kent's Island, S end, *D. Potter* 5030 (TRT); Colches-

ter Co., Folleigh Lake, *A. R. Prince & C. E. Atwood* 277 (DS, MICH); Colchester Co., Lower Five Islands, *A. R. Prince & C. E. Atwood* 1128 (DAO, DS); Cumberland Co., Tidnish, *C. H. Read* 12282 (ACAD); Inverness Co., Whycocomagh Indian Reservation no. 2, *P. R. Roberts* 59-936 (UNB); Pictou Co., Bayview, *C. Robinson* 216 (NY); Digby Co., Brier Island, *Roland et al.* 137 (ACAD); Yarmouth Co., Carleton, *M. V. Roscoe et al.* 11073 (ACAD, DAL, MT, TRT); Digby Co., Sandy Cove, *M. V. Roscoe & J. E. Graustein* 11074 (ACAD); Guysborough Co., Guysborough, *J. Rousseau* 35351 (CAN, MT); Cape Breton, Victoria Co., Port Bevis, *E. Scammon* 4380 (GH); Cape Breton Co., Grand Narrows, *E. Scammon* 4381 (GH, MIN); Digby Co., Brier Island, *W. B. Schofield* 1661 (MT); Cumberland Co., New Prospect, *W. B. Schofield* 3156 (ACAD); Cumberland Co., Isle au Haute, *W. B. Schofield* 3747 (ACAD); Cumberland, Lake Killarney, *W. B. Schofield* 4154 (ACAD); Colchester Co., Moose Island, *W. B. Schofield* 5012 (ACAD); Grand Manan, *W. Seaman s.n.* (MTMG); Brier Island, *E. C. Smith et al.* 137 (DAO); Richmond Co., Roberta, *E. C. Smith et al.* 722 (ACAD); Inverness Co., Red River, *E. C. Smith et al.* 1104 (ACAD); Victoria Co., Salmon R., *E. C. Smith et al.* 2654 (ACAD, DAO, MT, NCSC); Antigonish Co., Keppoch, *E. C. Smith et al.* 2891 (ACAD, DAO); Victoria Co., Cape North, *E. C. Smith et al.* 3722 (ACAD); Victoria Co., Ingonish R., *E. C. Smith et al.* 4318 (ACAD, MT); Inverness Co., Glendyer, *E. C. Smith et al.* 4782 (ACAD, MT, TRT); Richmond Co., Loch Lomand, *E. C. Smith et al.* 5424 (ACAD); Inverness Co., 4 mi. W of Big Southwest Brook, *E. C. Smith et al.* 6531 (ACAD, MT); Inverness Co., Cheticamp R., *E. C. Smith et al.* 7811 (ACAD, MT); Victoria Co., Indian Brook, *E. C. Smith et al.* 8131 (ACAD, TRT); Cape Breton Co., North Light, Scatari, *E. C. Smith et al.* 8473 (ACAD, DAO); Inverness Co., Skye Glen, *E. C. Smith et al.* 8676 (ACAD, DAO, TRT); Lunenburg Co., Horseshoe Lake, *E. C. Smith et al.* 8990 (ACAD, MT); Inverness Co., Cape St. Lawrence, *E. C. Smith et al.* 11143 (ACAD); Queens Co., W of Eighth Lake, *E. C. Smith et al.* 11802 (ACAD); Digby Co., Cedarwood Lake, *E. C. Smith et al.* 15321 (ACAD); Victoria Co., Middle Branch of North R., "Big Lease," *E. C. Smith et al.* 16756 (ACAD); Richmond Co., Pringles Mt., *E. C. Smith et al.* 17788 (ACAD, DAO); Pictou Co., Brookland, *E. C. Smith et al.* 18152 (ACAD, DAO); Guysborough Co., Salmon River Lake, *E. C. Smith et al.* 18228 (ACAD); Colchester Co., West Branch, North R., *E. C. Smith et al.* 18975A (TRT); Colchester Co., Byer's Brook, *E. C. Smith et al.* 19037 (ACAD, MT); Inverness Co., Sight Point, *E. C. Smith et al.* 21113 (ACAD); Lunenburg Co., Crousetown, *E. C. Smith et al.* 21253 (ACAD); 4 mi. E of Halls Harbor, *E. C. Smith et al.* 23262 (DAO); Hants Co., E of Minasville, *E. C. Smith et al.* 23570 (ACAD); Kings Co., Amethyst Cove, *P. C. Smith* 210 (ACAD); Pictou Co., Springville, *H. St. John* 1435 (CAN, CAS, GH, ISC, MIN, MT, US, WS); Inverness Co., Cape Breton Highlands National Park, McIntosh Brook Picnic Site, *L. J. Uttal* 7451 (VPI); Hants Co., W Gore, *F. Wallace* 86 (MTMG); Truro, Victoria Park, *R. Witmore in 1919* (MTMG); Kings Co., Cape Split, *M. N. Zinck* 282 (DAO); Kings Co., near Summit Lake, *M. N. Zinck* 632 (DAO). ONTARIO: Grimsley, *C. Armstrong in 1892* (US); Nipissing Dist., Algonquin Park, near Lake of Two Rivers, *P. Bahr in 1963* (MTMG); Thunder Bay Dist., Sibley Provincial Park, *J. A. Bailey* 1047 (TRT, V); Thunder Bay Dist., Oliver Twp, Kakabeka Falls, *J. A. Bailey* 1808 (TRT, WTU); Thunder Bay Dist., Sibley Peninsula, N end of Lake Marie Louise, *J. A. Bailey* 2496 (V); Timiskaming Dist., New Liskeard, 3 mi. E in Harris Twp, *W. K. W. Baldwin* 5205 (CAN, SASK, TRT); Kenora Dist., Sandybeach Lake, *W. K. W. Baldwin* 8507 (TRT); Kenora Dist., Ignace, *W. K. W. Baldwin* 9009 (CAN, H, MIN, TRT); Thunder Bay Dist., Allan Water R., inlet river from Kawaweogama Lake, *W. K. W. Baldwin* 9201; Cochrane Dist., Matheson, *W. K. W. Baldwin & A. J. Breitung* 3233 (CAN, H, TRT, WIN); Cochrane Dist., Mammamattawa, Kenogami R., *W. K. W. Baldwin et al.* 6424 (CAN); Cochrane Dist., junction of Mattagami & Missinaibi Rivers, *W. K. W. Baldwin & A. Porsild* 7312 (CAN); Black Sturgeon Lake, *R. L. Beacroft in 1950* (HAM); Kenora Dist., Blacky Bay, S shore of Kakagi Lake, *P. Bentley* 57513 (CAN, DAO, MTMG); Carleton Co., Gloucester, *B. Billings in 1866* (NA); near Toronto, *Biltmore Herb. in 1897* (US); Petawana Forest Experiment Station, *E. Blair* 10-140 (NA); Peterborough Co., 2 mi. N of Havelock, *R. S. Bobbette* 4358 (CAN); Grey Co., 2.5 mi SE of Eugenia, *R. S. Bobbette* 4873 (CAN); Algoma Dist., Agawa R. at rte 17, *D. E. Boufford* 18744 (KYO, MHA, MO); Algoma Dist., 0.9 mi. N of Gravel R. on rte 129, *D. E. Boufford* 18783 (MO); Sudbury Dist., 8.2 mi. N of the Manitoulin Dist. line on rte 68, *D. E. Boufford* 18802 (MO); Manitoulin Dist., 6.8 mi. N of the ferry and the S end of hwy 68 on hwy 68, *D. E. Boufford* 18803 (KYO, MO); Grey Co., ca. 5 mi. N of Durham, *D. E. Boufford* 18813 (BM, CM, K, KYO, MHA, MO, P, PE); Turkey Point, Lake Erie, *W. M. Bowden in 1935* (HAM); Martin R., Sisk, *W. B. Brierly & W. H. Hodge* 633 (TRT); York Co., Kettleby Kabin near Schamberg, *H. H. Brown in 1925* (CAN); York Co., Pottageville, *H. H. Brown in 1929* (TRT); Peel Co., Credit Forks, *H. H. Brown in 1929* (TRT); Leeds Co., Westport, *H. H. Brown* 4232 (TRT); Kenora, *A. H. R. Buller in 1918* (WIN); London, *T. Burgess in 1879* (MTMG); Dundas, Dundas Ravine, *T. Burgess in 1888* (HAM); Brant Co., New Durham, *R. F. Cain* 208 (TRT, W); Ontario Co., ca. 2.5 mi. N of Leaskdale, Scott Twp, *P. M. Catling & S. McKay in 1970* (TRT); Algoma Dist., near Pancake R., near Lake Superior shore, *P. M. Catling et al. in 1975* (TRT); Russell Co., Cumberland Twp, *W. Cody & J. Calder* 554 (DAO, KANU); Victoria Co., Laxton Twp, 3 mi. W of Norland, *M. Cody & J. Parmelee* 6665 (DAO); Port Carling, *L. C. Coleman in 1940*



(TRT); Haliburton Co., Harburn Twp, *V. Connolly 207* (TRT); Thistletown, *F. S. Cook in 1948* (TRT); Thunder Bay Dist., Oliver Twp, *Cormack & Mayall in 1936* (MICH); Thunder Bay Dist., Victoria Island, Thunder Bay, *Cormack & Mayall in 1936* (TRT); Algoma Dist., Lake Superior Provincial Park, Old Woman Bay, *F. N. Cowell 154* (DAO); Algoma Dist., hwy 17, Lake Superior Provincial Park, *F. N. Cowell 262* (TRT); Thunder Bay Dist., Lake Nipigon, Geikie Island, *A. Gringan 144* (TRT); Patricia Dist., island in Nikip Lake, *A. T. Cringan P140* (TRT); Norfolk Co., Charlotteville Twp, Turkey Point, *J. E. Cruise 6298* (CU, TRT); near Lake of the Woods, *G. M. Dawson in 1873* (CAN); Ingolf, *W. Denike 549* (DAO, NA); Victoria Co., Bexley Twp, ca. 4 mi. SW of Coboconk, *W. S. Dickinson 104* (CAN, DAO, TRT); Victoria Co., Laxton Twp, ca. 2 mi. NW of Norland, *W. S. Dickinson 127* (CAN, DAO, TRT); Simcoe Co., Vespra Twp, ca. 7 mi. W of Barrie, *W. S. Dickinson et al. 441A* (CAN, DAO, MTMG, NCU, TRT); Parry Sound Co., Hagerman Twp, Lorimer Lake, *W. S. Dickinson 485* (CAN, DAO, MTMG, NCU, TRT); Cochrane Co., Horden Twp, ca. 2 mi. S of Moosonee, *W. S. Dickinson & E. Haber 504* (CAN, DAO, TRT); Leeds Co., Otter Lake near Lombardy, *W. Dore & W. Cody 47-389* (DAO); Frontenac Co., Sharbot Lake, *W. Dore & J. Gillett 13861* (DAO); Greenville Co., 2.3 mi. N, 15°W of Prescott, *W. Dore et al. 17827* (DAO, TRT); Northumberland Co., S of Brighton, *M. Dumais 255* (DAO, TRT); Leeds Co., Oliver's Ferry, Rideau Park, *T. Edmonson in 1898* (NY); Haley's Station, *T. Edmonson 2589* (NY); Leeds Co., Rideau Ferry, *T. Edmonson 2879* (NY); Port Stanley, *G. L. Fisher in 1909* (OKLA); Muskoka Co., Lumina, Lake of Bays, *M. J. Fisher in 1925* (CU); Huron Co., Grey Twp, 8.5 mi. E of Brussels, *G. Fleischmann 125* (DAO); Beechwood, *J. Fletcher 863* (PH); Plevna, *J. Fowler in 1902* (CAN, DAO, GH); Peel Co., Caledon Lake, *L. Gad in 1971* (TRT); Durham Co., Darlington Twp, N of Haydon, *L. Gad et al. in 1974* (TRT); Thunder Bay Dist., N side of Grass Lake, Sibley Peninsula, *C. E. Garton et al. 1337* (DAO, MIN, MT, TRT, US, WIS); Thunder Bay Dist., NE corner of Roundtable Lake, Hardwick Twp, *C. E. Garton 1481* (DAO, MIN, MT, PENN, SDU, TRT, TUR, W, WIN); Thunder Bay Dist., SE of Lenore Lake, Pardee Twp, *C. E. Garton 1919* (DAO, GH, H, MIN, NY, RM, TRT, UC, US, W, WIN); Thunder Bay Dist., 0.25 mi. W of Perrys Bay, Sibley Twp, *C. E. Garton 2239* (DAO); Rainy River Dist., French Lake Headquarters (Quetico), *C. E. Garton 4742* (DAO, MT, TRT); Thunder Bay Dist., S side of St. Ignace Island, *C. E. Garton 6406* (DAO, NCU, TRT); Thunder Bay Dist., SW corner of St. Ignace Island, NE corner of Squaw Bay, *C. E. Garton 6637* (DAO, GH, H); Thunder Bay Dist., Kilkenny Twp, MacDiarmid, *C. E. Garton 7661* (DAO, MAK, TRT); Thunder Bay Dist., Lake Nipigon, Cooke Point, *C. E. Garton 7793* (ALTA, DAO); Rainy River Dist., 5.5 mi. below Rainy River town, *C. E. Garton 8682* (DAO, UC); Rainy River Dist., Duke Twp, E of Pine-wood, *C. E. Garton 9640* (DAO, MASS, MIN, SASK, TRT); Thunder Bay Dist., Dorion Twp, Coldwater Creek at Black Bay, *C. E. Garton 9633* (CM, DAO, TRT); Thunder Bay Dist., 9.3 mi. N of Black Sturgeon Ranger Station, *C. E. Garton 10380* (CAN, HAM, UC); Thunder Bay Dist., NW corner of Black Sturgeon Lake, *C. E. Garton 12208* (CAN, H, NDA, TRT, UBC); Thunder Bay Dist., SE corner of Black Sturgeon Lake, *C. E. Garton 12351* (CAN, DAO, TRT, UBC); Algoma Dist., 0.5 mi. N of Wawa along hwy 101, *C. E. Garton et al. 14320* (ACAD, CAN, H, MICH, NDA, NLU, SASK, TRT); Algoma Dist., mouth of Michipicoten R., *C. E. Garton et al. 14492* (ACAD, CAN, H, MICH, NDA, NLU, SASK, TRT, UBC); Pukaskwa National Park, 2.5 km E of Oiseau Bay, *C. E. Garton 16255* (CAN); 1 mi. N of Amherstview, *A. E. Garwood 1018* (TRT); Northumberland Co., Brighton Twp, Presque Isle Park, *J. Gillett & J. Calder 6337* (DAO, NY, TRT); Hastings Co., 3.5 mi. NNW of Marmora, *J. Gillett & J. Calder 6377* (DAO); Stormont Co., 3 mi. W of Cornwall, *J. Gillett & W. Dore 7639* (DAO); Stormont Co., Osnabruck Twp, 2 mi. NE of Wales, *J. Gillett 7794* (DAO); Renfrew Co., 2 mi. NE of Eganville, Mink Lake, *J. Gillett 9501* (DAO); Glengarry Co., Summerstown, *G. Gogo 470* (DAO); Algoma Dist., S Lizard Island, *C. O. Grassl 588* (MICH); Algoma Dist., Goulais Bay, *C. O. Grassl 590* (MICH); Algoma Dist., Leach Island, *C. O. Grassl 591* (MICH); Algoma Dist., Nestorville, *C. O. Grassl 5483* (MICH); Manitoulin Dist., Indian Village at South Bay, *C. O. Grassl 6004* (MICH); Manitoulin Dist., Little Current, *C. O. Grassl 6006* (MICH); Durham Co., 3 mi. NE of Blackstock, *E. Haber 82* (CAN); Durham Co., Cartwright Twp, 3 mi. NE of Blackstock, *E. Haber 538* (CAN, DAO, MTMG, TRT); York Co., Toronto, Serena Gundy Park, *E. Haber 541* (CAN, TRT); Ontario Co., Greenwood, Swiss Chalet Park, *E. Haber 548* (CAN, DAO, MTMG, TRT); York Co., Markham Twp, just E of Gormley, *E. Haber 551* (CAN, DAO, TRT); York Co., King Twp, ca. 2 mi. NW of Nobleton, *E. Haber 555* (CAN, DAO, MTMG, TRT); Midland, Wye Lake, *D. Haddow 126* (DAO); Frontenac Co., Bedford Twp, Frontenac Park, *R. Hainault & I. Macdonald 5132* (CAN, SASK); Peel Co., Cold Creek Swamp near Bolton, *J. M. Hamley in 1959* (TRT); Ottawa Dist., Carleton Co., Gloucester Twp, *E. Hart 1945* (UTC); Thunder Bay Dist., Fallingsnow Lake, *W. & M. Hartley 2116* (CAN, MAK, V); Hastings Co., 1 mi. W of Coe Hill, *C. Heidenreich 428* (DAO, TRT); Nipissing Dist., Notman Twp, *R. C. Hosie 118* (TRT); Thunder Bay Dist., Copper Island, *R. C. Hosie et al. 1708* (TRT, UC, WS); Thunder Bay Dist., Jackfish, *R. C. Hosie et al. 1710* (GH, MT, TRT); Thunder Bay Dist., Mortimer Island, *R. C. Hosie et al. 1711* (CAN, TRT); Algoma Dist., Magpie Falls, *R. C. Hosie et al. 1904* (HAM, TRT, UTC); Algoma Dist., vicinity of Michipicoten Harbour, *R. C. Hosie et al. 1905* (ACAD, NY, TRT); Algoma Dist., Mission

Lake Portage, *R. C. Hosie et al. 1906* (MIN, TRT); Haliburton Co., Harcourt Twp, *D. Hoy in 1974* (TRT); Ontario Co., Reach Twp, *D. Hoy et al. in 1975* (TRT); York Co., E Guillimbury Twp, *D. Joy et al. in 1977* (TRT); Chalk R., Dominion Forest Experiment Station, *I. Husitch in 1946* (CAN); Thunder Bay Dist., Cloud Bay, *D. L. Jacobs 22* (MIN); Smoke Lake, Algonquin Park, *M. F. Jackson in 1946* (TRT); Waterloo Co., Bridgeport Dam, *E. L. James 262* (HAM); Elgin Co., Malahide Twp, *L. James in 1950* (DAO); Elgin Co., 5 mi. SW of Aylmer, *L. James 1792* (DAO, PAC); Carleton Co., Ottawa, Dow's Swamp, *L. Jenkins 6594* (DAO); head of Surprize Lake, Thunder Cape, Lake Superior, *O. E. Jennings et al. 1943* (CM, CU, DAO); Rossport, *O. E. & G. K. Jennings 2724* (CM); along Kaministiquia R. near Stanley, *O. E. & G. K. Jennings 3132* (CM); Edwards Island, Lake Superior, *O. E. & G. K. Jennings 3761* (CM); SE corner Lake Nipigon, N of Orient, *O. E. & G. K. Jennings 6407* (CMI); 0.5 mi. W of Jellicoe, *O. E. & G. K. Jennings 14537* (CM); Oscar to Knowlton, *O. E. & G. K. Jennings 15536* (DAO); Niagara Glen, *F. Johnson in 1925* (NY); ca. 10 mi. N of Finland, *J. Kane 2127* (WIS); Glencoe, *N. Keith in 1893* (MTMG); Kenora Dist., Rushing R. W of hwy 71, 4 mi. S of hwy 17, *G. M. Keleher 127* (WIN); Rainy River Dist., Basswood Lake near Ottawa Island, *D. Knight 200* (AUG); Frontenac Co., Eagle Lake, *P. V. Krotkov in 1939* (TRT); Temagami Forest Reserve, Bear Island, *P. V. Krotkov 5477* (TRT); Bruce Peninsula, Tobermory, *P. V. Krotkov 7635* (GH, TRT); Bruce Peninsula, Stokes Bay, *P. V. Krotkov 9242* (CU, TRT, US, WIS); Bruce Peninsula, Hope Bay, *P. V. Krotkov 9858* (TRT); Bruce Peninsula, Dryers Bay, *P. V. Krotkov 10731* (DAO, TRT); Baswood Lake, Bayley Bay, *O. Lakela et al. 16339* (MIN); Norfolk Co., Windham Twp, *M. Landon 492* (HAM); Norfolk Co., Turkey Point, *M. Landon 493* (TRT); Portage, Long Lake, *E. E. Laughlin 1353* (OS); Sand R. at Lake Superior, *M. Lechowicz & W. Post, III in 1973* (WIS); Spike Lake on rte 556, NE of Sault Ste. Marie, *M. Lechowicz & W. Post, III in 1973* (WIS); Newington, *J. H. Lemon 817* (UBC); Waterloo Co., Preston, *R. M. Lewis 153* (TRT); Golden Lake, *H. Lloyd in 1948* (DAO); St. Lanark Co., S of Bolingbroke, *R. A. Lubue 783* (TRT); near Belleville, *J. Macoun in 1865* (CAN); Hastings Co., *J. Macoun 58* (GH); near Britannia, *J. Macoun 567* (DAO); Tilsonburg, *J. Macoun 44423* (CAN, GH); Mississauga, Rattray Marsh, *I. Macdonald 1598* (CAN); Peel Co., Brampton, *H. G. Macklin in 1935* (HAM); Norfolk Co., 5 mi. NE of Port Rowan, *P. F. Maycock 1702* (MTMG); Huron Co., 2 mi. NE of Bayfield, *P. F. Maycock & O. Maryniak 2843* (MTMG); Huron Co., Tuckersmith Twp, 3 mi. NE of Hensall, *P. F. Maycock 2873* (MTMG); Elgin Co., 2.5 mi. NW of Wallacetown, *P. F. Maycock 5246* (MTMG); Norfolk Co., 2 mi. N of Middleton, *P. F. Maycock & O. Maryniak 6224* (DAO, MTMG); Norfolk Co., 3 mi. N of Port Dover, *P. F. Maycock & E. Visser 7961* (MTMG, NCU, TRT); Lincoln Co., Glen Elgin, *W. McCalla in 1896* (ALTA); Muskoka Co., MacTier, *E. H. McClelland in 1921* (CM); 60 mi. SSE of Red Lake, near Cedar Lake, *D. McMillan 60* (DAO); Algoma Dist., Michipicoten near Wawa, *J. McNeill 3010* (DAO); Cochrane Dist., SW of Kapuskasing in Sulman Twp, *J. B. Millar & E. Bonner 61* (TRT); Louth Twp, 1 mi. S of Jordan, *B. Miller 398* (HAM); Welland Co., Stamford Twp, Niagara Gorge, *B. Miller 446* (HAM); Merivale, *W. Minshall in 1933* (DAO); Carleton Co., Fitzroy Twp, *W. Minshall 3302* (DAO); Brant Co., Brantford Twp, *W. Minshall 3904* (DAO); Sandborn Bay, vicinity of Sandy Lake, *D. R. Moir 4099* (GH, MIN, NDA); Waterloo Co., Waterloo, *F. Montgomery 262* (DAO, GH); Deep River, *M. I. Moore in 1966* (KYO); Glen Morris to Wrigley's Corner, *J. K. Morton NA 3089* (CAN); Parry Sound Dist., Laurier, *L. R. Moyer 2611* (MIN, NY); Georgian Bay National Park, *R. Muir 62B106* (DAO); Renfrew Co., Maria Twp, 0.75 mi. W of Bissett, *G. Mulligan 598* (DAO); Kent Co., Rondeau Park, *R. W. Neal 359* (HAM); Thunder Bay Dist., Sauerbrei Lake, *A. Oaks 1098* (TRT); Russell Co., 0.4 mi. W of Cumberland, *J. Op de Beeck in 1969* (MTMG); Lanarck Co., ca. 5.5 mi. S of Perth, *A. Pokorny in 1968* (MTMG); Hudson Bay Lowlands, Attawapiskat R. near junction with Muketei R., *A. E. Porsild et al. 20178* (CAN); Niagara Falls, *W. J. Potter in 1907* (TRT); Thunder Bay Dist., Paipoonge Twp, *J. Purchase in 1960* (DAO, TRT); Algoma Dist., ca. 1.7 mi. N of Fenwick Twp school, *J. Purchase in 1960* (DAO, TRT); Algoma Dist., Lake Superior Provincial Park, *J. Purchase in 1961* (TRT); Speed R., Guelph, *H. N. Racicot in 1921* (HAM); Simcoe Co., Nottawasaga Twp, *A. A. Reznicek 3208* (TRT); Cochrane Dist., Dyer Twp, Onakawana, *J. L. Riley in 1972* (TRT); Cochrane Dist., Pierre-Montreuil Park Reserve, *J. L. Riley in 1974* (TRT); Rainy River Dist., 1.5 km NE of Atikokan, *G. S. Ringius 15* (AKAD); York Co., Scarborough Twp, *W. Robbins in 1908* (DAO); 7 mi. W of Chapleau, *D. Ropke 304* (DAO); Charleton Co., Gloucester Twp, *H. Senn 1918* (DAO); Hastings Co., Modoc Twp, 1.5 mi. N of Cooper, *M. J. Shchepanek & J. H. Soper 594* (CAN, MTMG, SASK, TRT, WTU); Perth Co., Fullerton Twp, 3 mi. SE of Mitchell, *J. K. Shields 223* (CAN, TRT); Haliburton Co., Minden Twp, *E. & E. Skelton 337* (TRT); Muskoka Dist., near Huntsville, *J. H. Soper in 1949* (TRT); Norfolk Co., Lake Erie, Turkey Point, *J. H. Soper 175* (DAO); Carleton Co., Goulbourn Twp, *J. H. Soper et al. 3224* (DAO, TRT); Durham Co., Hope Twp, 5 mi. W of Port Hope, *J. H. Soper & H. Dale 4007* (DAO, TRT); Brant Co., Dumfries Twp, 2 mi. E of Ayr, *J. H. Soper & H. Dale 4123* (DAO, GH, TRT); York Co., Vaughan Twp, 3 mi. E of Kleinburg, *J. H. Soper & H. Dale 4131* (DAO, GH, TRT); Simcoe Co., Adlaja Twp, ca. 3 mi. NE of Hockley, *J. H. Soper & J. K. Shields 4827* (TRT); Simcoe Co., Nottawasaga Twp, *J. H. Soper & J. K. Shields 4834* (CAN, MT, NCU, TRT); Parry Sound Dist., Croft Twp, *J. H. Soper 5312* (MTMG, TRT); Leeds Co., near

Chaffey's Locks, Lake Opinicon, *J. H. Soper* 5579 (ACAD, TRT); Huron Co., ca. 8.5 mi. E of Brussels, *J. H. Soper & G. Fleischmann* 6412 (CAN, TRT); Grey Co., Osprey Twp, *J. H. Soper et al.* 7475 (CAN, MIN, TRT); Manitoulin Dist., Frechette Bay just W of Murphy Point, *J. H. Soper & C. Heidenreich* 8985 (CAN, DAO, TRT); Manitoulin Dist., Heywood Island, *J. H. Soper & W. D. Murray* 10070 (CAN, NCU, TRT); Thunder Bay Dist., Michipicoten Island, *J. H. Soper & F. A. Fraser* 10939 (CAN, TRT); Christina, *G. Stirrett & D. Arnott in 1936* (DAO); Wellington Co., Puslinch, *J. J. Stroud in 1937* (TRT); Middlesex Co., London Twp, *W. D. Sutton* 151 (TRT); Tillsonburg, *A. Tamsalu in 1956* (HAM); Simcoe Co., Dunedin, *T. M. C. Taylor in 1934* (TRT); Thunder Bay Dist., Norma Creek, *T. M. C. Taylor* 736 (GH); Thunder Bay Dist., Red Sandstone Lake, *T. M. C. Taylor* 826 (DS, TRT, UC, UTC); Thunder Bay Dist., Michipicoten Island, *J. H. Soper & F. A. Fraser* 10939 (CAN, TRT); Christina, *G. Stirrett & D. Arnott in 1936* (DAO); Wellington Co., Puslinch, *J. J. Stroud in 1937* (TRT); Middlesex Co., London Twp, *W. D. Sutton* 151 (TRT); Tillsonburg, *A. Tamsalu in 1956* (HAM); Simcoe Co., Dunedin, *T. M. C. Taylor in 1934* (TRT); Thunder Bay Dist., Norma Creek, *T. M. C. Taylor* 736 (GH); Thunder Bay Dist., Red Sandstone Lake, *T. M. C. Taylor* 826 (DS, TRT, UC, UTC); Thunder Bay Dist., Port Coldwell, *T. M. C. Taylor et al.* 1208 (CAN, TRT, UBC); Thunder Bay Dist., Heron Bay, *T. M. C. Taylor et al.* 1210 (CAN, TRT, UBC); Algoma Dist., Batchawana Island, *T. M. C. Taylor et al.* 1866 (TRT, V); Algoma Dist., Havilland Bay, *T. M. C. Taylor et al.* 1867 (MT, TRT); Algoma Dist., Mamainse Point, *T. M. C. Taylor et al.* 1868 (CAN, TRT, UBC, WTU); Algoma Dist., Coppermine Point, *T. M. C. Taylor et al.* 2412 (TRT, UTC); Perth Co., Wallace Twp, *G. R. Thaler* 226 (TRT); Huron Co., Morris Twp, Burssels, *G. R. Thaler* 262 (TRT); Huron Co., Wawanosh Twp, Wingham, *G. R. Thaler* 269 (TRT); Perth Co., Hibbert Twp, Staffa, *G. R. Thaler* 272 (TRT); Dufferin Co., Mono Twp, Orangeville, *G. R. Thaler* 278 (TRT); Middlesex Co., Lobo Twp, *G. R. Thaler* 288 (TRT); Waterloo Co., Wilmot Twp, New Hamburg, *G. R. Thaler* 292 (TRT); Huron Co., Turnberry Twp, Wroxtor, *G. R. Thaler* 395 (TRT); Huron Co., Hullett Twp, Londesborough, *G. R. Thaler* 417 (TRT); Perth Co., Logan Twp, Mitchell, *G. R. Thaler* 433 (TRT); Algoma Dist., Sand R. near its mouth, Lake Superior, *E. G. Voss & R. L. Jeanne* 10613 (TRT); Simcoe Co., De Grassi Point, Lake Simcoe, *E. Walker in 1894* (TRT); York Co., King Twp, *E. Walshe* 129 (CAN, DAO, MTMG, TRT); Bruce Peninsula, Red Bay, *W. R. Watson* 3255 (TRT); Algonquin Park, Joe Lake, *W. R. Watson* 3795 (DAO); Algonquin Park, N side of Island Lake, *W. R. Watson* 4281 (ACAD, TRT); Edmonton, *J. White*, 9066 (CAN); Muskoka Co., Morrison Twp, *R. E. Whiting* 781 (TRT); vicinity of Fort William, *C. Williamson* 1822 (PH); Bryon Region, *A. Wood in 1934* (DAO); Elgin Co., Yarmouth Twp, *D. Young* 119 (TRT). PRINCE EDWARD ISLAND: Kings Co., Bay Fortune, *H. E. Aitken* 42 (ACAD); Prince Co., Campbellton, *D. Erskine & A. J. Smith* 1926A (DAO); Kings Co., Bear R., ca. 1 mi. W of station, *D. Erskine & A. J. Smith* 1991 (ACAD, DAO, MT); Queens Co., Charlottetown, *M. L. Fernald et al.* 7838 (PH); Kings Co., Murray R., *D. Griffin in 1970* (TUR); Tracadie, *J. Macoun* 9067 (CAN); Bideford, *A. R. A. Taylor in 1948* (DAO, UNB). QUEBEC: Saguenay Co., Natashquan, *E. C. Abbe* 1252 (GH, MIN); Gaspé-Est Co., Perce, *J. Adams in 1935* (DAO); Gatineau Co., Blue Sea Lake, *C. Anderson in 1945* (CAN); Gatineau Co., above Kirk's Ferry, *C. Anderson in 1946* (CAN); Gatineau Co., Chilcott's Bog near Alcove, *C. Anderson in 1952* (CAN); Brome Co., Abercorn, *P. Bahr in 1963* (MTMG); Compton Co., Birchtown P.O., *J. A. Bailey* 1557 (TRT, V); West Abitibi Co., La Sarre, 14 mi. W at Lake Abitibi, *W. K. W. Baldwin & A. J. Breitung* 2869 (CAN, GH, MT); Abitibi Co., Taschereau, *W. K. W. Baldwin & A. J. Breitung* 5243 (CAN, MT, MTMG); Timiskaming Co., Ville Marie, 3 mi. S at Baie Laperriere, *W. K. W. Baldwin* 5942 (CAN, MT); Gaspé-Est Co., Grande-Riviere, *R. Barabe & E. Campagna in 1940* (DAO); Bonaventure Co., Port-Daniel, *R. Barabe & L. Dube in 1940* (DAO); Lac St. Jean-Ouest Co., Roberval, *J. Barnhart* 732 (NY); Rimouski Co., Bic, *E. Bartram & B. Long* 231 (PH); Rouville Co., Mt. St.-Hilaire, *A. Beaulieu in 1962* (MTMG); Stanstead Co., Beebe, *A. Beaulieu* 16 (DAO, MTMG); Matapedia Co., Amqui, *A. Belzile & C. Gervais* 28624 (DAO, UBC); Magdalen Islands, Amherst Island, S Cape, *P. A. Bentley & D. H. Webster* 364 (DAO); Riviere du Loup Co., Riviere du Loup, *A. Blain et al. in 1941* (MT); Matapedia Co., Sainte-Irene, *A. Blain* 184 (CAN, GH, MT, US); Richmond Co., between Burbank Hill & Shipton Pinnacle, *V. Blais & C. Hamel* 11197 (ACAD, CM, SASK, TRT); Richmond Co., Richmond, *J. Blankenship in 1897* (GH); Terrebonne Co., Lac Tremblant, *C. M. Boardman* 138 (CM); Matane Co., Mont Blanc, *B. Boivin & A. Blain* 536 (MT); Matane Co., mt. to the E of Matane, *B. Boivin & A. Blain* 584 (DAO, ISC, MT); Charlevoix Co., Les Eboulements, *B. Boivin* 1419 (CU, DAO, ISC, MT, TEX); Huntingdon Co., St.-Amicet, *A. Bouchard & S. Hay* 4215 (CAN); Megantic Co., St. Ferdinand ("Bernierville"), *A. Bouchard et al.* 69-652 (MTMG); Frontenac Co., 1.7 mi. N of St.-Cecile, *A. Bouchard & H. Gilbey* 69-656 (MTMG); Sherbrooke Co., 2 mi. N of Coaticook, *A. Bouchard & D. Gilbey* 69-657 (MTMG); Lac St.-Jean Est Co., Chambord, *C. Bouchard* 70-566 (DAO, MAK); Lac St.-Jean Est Co., Hebertville, *C. Bouchard* 70-676 (DAO); Saguenay Co., Ilets Jeremie, *S. Brisson* 889 (MT); Chicoutimi Co., Anse St. Jean, *S. Brisson* 5642 (MT); Chicoutimi Co., Petit Saguenay, *S. Brisson* 5739 (MT); Chicoutimi Co., Cap a l'Est, *S. Brisson* 5774 (MT); Gaspé Ouest Co., Courcelette, Plaque-Malade, *S. Brisson et al.* 6133 (CAN); Saguenay Co., Grandes Bergeronnes, *S. Brisson* 60-280 (MT); Chicoutimi Co., Harvey, Cap

Jaseux, *S. Brisson* 74189 (CAN, VSC); *S. Brisson* 76521 (MTMG, NLU); Bonaventure Co., Cascadia Valley, *J.-D. Brule et al.* 35130 (MT); Saguenay Co., Blanc-Sablon, *J. Brunel* 108 (MT); Montcalm Co., Provost Lake, St. Donat, *M. Cailloux in 1936* (MT); Papineau Co., Templeton Parish, *J. Calder M-83* (DAO); L'Islet Co., Trois-Saumons, *J. Cayouette* 1045 (H); Matane Co., St.-Rene Goupil, *R. & J. Cayouette* 55-44 (TRT); Matane Co., St.-Nil, *R. Cayouette* 56-282 (H); Chicoutimi Co., St.-Fulgence, *R. Cayouette* 58-117 (DAO); Chicoutimi Co., Labrousse, *R. Cayouette & S. Brisson* 64717 (CAN, DAO, MT, SASK); Richmond Co., Cleveland, *E. Chamberlain & C. Knowlton in 1923* (GH); Missisquoi Co., Georgeville, *J. R. Churchill in 1902* (GH, MT); Rouville Co., Rougemont, *L. Cinq-Mars in 1951* (DAO, MT, MTJB); Bonaventure Co., Matapedia, *L. Cinq-Mars L-279* (DAO); Charlevoix Co., Notre Dame des Monts, *L. Cinq-Mars et al.* 66-325 (ACAD, DAO, GH, MAK, MTMG, OSC, TRT, UBC, UC, UNB, V); Missisquoi Co., Frelighsburgh, *L. Cinq-Mars & A. Vezina* 67-85 (ACAD, CAN, DAO, MAK, MTMG, OSC, TRT, UBC, UC, V); L'Islet Co., Trois-Saumons, *L. Cinq-Mars & P. Masson* 71-373 (TRT); Matane Co., W of Grosses Roches, *R. T. Clausen & H. Trapido* 2861 (BH, CU, PAC); Papineau Co., Buckingham, *Fr. Cleonique* 7097 (MT); Montreal & Jesus Islands Co., Mont-Royal, *Fr. Cleonique* 9213 (MT); Deux-Montagnes Co., Okla, *Fr. Cleonique* 11447 (MT); Joliette Co., Ste.-Beatrix, *L. P. Coiteux* 98 (MT); Gaspé-Est Co., mouth of Dartmouth R., *J. Collins et al.* 5123 (GH); Gaspé-Ouest Co., Cap Au Renard, *W. P. Cottam* 11678 (UT); Montmorency Co., Laurentides Park, Lake Horatio-Walker, *Y. Desmarais* 301 (MT, WIS); Gatineau Co., Hincko Twp, *W. G. Dore & F. Beales* 22359 (DAO, MTMG, TRT); Deux-Montagnes Co., Oka, Sulpiciens, *A. Dubois* 427 (NY); Matane Co., 3 mi. W of Metis Beach, *G. & P. DuBoulay* 3225 (MTMG); Arthabaska Co., Trois Lacs, *Fr. Euplius* 537 (MT); Shefford Co., Granby, *Fr. Fabius* 367 (CAN, MT); Gaspé-Ouest Co., Mt. St.-Anne, *FF. Fabius & Allyre* 3088 (DAO); Rouville Co., Mont Yamaska, *Fr. Fabius* 5525 (DAO); Gatineau Co., Blue Sea Lake, Big Island, *N. C. Fassett* 18087 (WIS); Magdalen Islands, Grindstone Island, Grindstone, *M. L. Fernald et al.* 7836 (CAN, GH, MT, NY, PH, WS); Magdalen Island, E Cape & E Point, *M. L. Fernald et al.* 7837 (PH); Kamouraska Co., Ste. Anne, *F. F. Forbes in 1907* (DS); Matane Co., Little Metis, *J. Fowler in 1906* (GH, TRT), *J. Fowler in 1908* (MO); Gatineau Co., Hull, *F. Fyles in 1911* (DAO); Quebec Co., Montmorency Falls, *F. Fyles in 1915* (DAO); Gatineau Co., Gatineau Park, *J. M. Gillett* 15177 (CAN, TRT); Bonaventure Co., Bonaventure R., *V. Gerardin et al.* 5211 (DAO); Madeleine Isle Co., Grosse Island, Rockhill Point, *M. Grandtner et al.* 8255 (DAO); Montmorency Co., Boischatel, *M. Gravel et al.* 69-116 (ACAD, MTMG, OS, PH, TRT, UBC, UNB); Terrebonne Co., Lac L'Achigan, near Shawbridge, *P. S. Green in 1959* (UC); Wolfe Co., Lake Nicolet, Gartby, *C. Hamel* 11537 (CAN, COLO, MTMG, UBC); Wolfe Co., Lake Aylmer, Garthby, *C. Hamel* 12569 (COLO, MTMG); Wolfe Co., Lake Elgin, Stratford, *C. Hamel* 14585 (BAL, H); Wolfe Co., Weedon, *C. Hamel* 14783 (CAN, CM, DAO); Wolfe Co., St.-Adrien de Ham, *C. Hamel* 18355 (ACAD, TRT, UC); Lac St. Jean Ouest Co., Peribonka Dist., Lac Alex, *I. Husitch* 282 (CAN, H); Abitibi Co., 24 mi. S of Val d'Or, *I. Husitch* 403 (MTJB); L'Islet Co., *H. A. C. Jackson* 99 (DAO, KANU); Gatineau Co., W of Kazabazua, *L. Jenkins et al.* 3639 (DAO); Argenteuil Co., Greenville Twp, *L. Jenkins* 9065 (DAO); Magdalen Islands, Grindstone Island, *F. Johansen in 1917* (CAN); Magdalen Islands, Amherst, *F. Johansen in 1917* (CAN); Brome Co., Bolton, *A. Johnstone in 1963* (MTMG); Missisquoi Co., Phillipsburg, *C. Knowlton in 1923* (GH); Temiscouata Co., Caban, *J. Kucyniak & D. Tardif* 286 (MT); Labelle Co., Nominique, *P. Labarre in 1936* (DAO); St. Maurice Co., La Maurice National Park, *G. Lamoureux & L. Durand* 71-42-12 (CAN); Missisquoi Co., Phillipsburg, *C. Lanouette in 1936* (MT); Missisquoi Co., 70 mi. SE of Montreal, Lake Selby, *G. F. Ledingham* 1670 (USAS); Riviere du Loup Co., St. Francoise, *E. Lepage* 15383 (DAO); Rimouski Co., St.-Fabien-sur-Mer, *E. Lepage* 15841 (DAO, SASK); Riviere du Loup Co., Trois Pistoles, *E. Lepage* 16961 (DAO); Saguenay Co., St. Mary Islands, Cliff Island, *H. F. Lewis in 1927* (CAN, CU); Saguenay Co., Natashquan, *H. F. Lewis in 1927* (CAN, CU); Saguenay Co., Tabatiere, *H. F. Lewis in 1928* (CAN, CU); Deux-Montagnes Co., La Trappe, Ile Bizard, *P. Louis-Marie in 1933* (SMU); Labelle Co., Bellerive, *FF. Lucien & Eloi* 678 (GH, MT); Anticosti Island, Salt Lake, *J. Macoun* 817 (US); Quebec Co., Montmorency Falls, *J. Macoun* 67942 (CAN, GH); Gatineau Co., Farrellton, *M. O. Malte* 262/23 (CAN, TRT); Gatineau Co., Wakefield, *M. O. Malte* 388/22 (CAN, MIN, W); Gaspé-Est Co., Bonaventure Island, *W. Manger* 51 (DAO); Lac St. Jean Ouest Co., St. Felicien, *Br. Marie-Anselm* 70 (DAO); Labelle Co. 15 mi. N of Mont Laurier, *F. Marie-Victorin et al.* 214 (GH, MT); Portneuf Co., Petit Saguenay, *F. Marie-Victorin* 10800 (MT); Madeleine Islands, Bassin Island, *FF. Marie-Victorin & Rolland-Germain* 10801 (DAO, GH, MIN, MT, US, WS); Terrebonne Co., vicinity of St. Jerome, *FF. Marie-Victorin* 11271 (GH, MT, US, WS); Anticosti Island, Riviere des Caps, *FF. Marie-Victorin & Rolland-Germain* 27229 (CAS, GH, MT); Saguenay Co., Natashquan, *FF. Marie-Victorin & Rolland-Germain* 28111 (MT); Brome Co., Bolton Pass, *F. Marie-Victorin et al.* 56294 (MT); Wolfe Co., Weedon, *P. Masson* 12490 (MTMG); Campton Co., Ste.-Marguerite-de-Linwick, *P. Masson* 13329 (TRT); Rouville Co., Mont St. Hilaire, *P. Maycock & O. Maryniak* 3255 (CAN, DAO, MTMG, TRT); Argenteuil Co., 4 mi. NW of Lachute, *P. Maycock & R. Goodland* 9164 (MTMG); Brome Co., 2 mi. E of Sweetsburg, *P. Maycock et al.* 11759 (MTMG); Brome Co., ca. 2 mi. E of Knowlton, *P. Maycock et al.* 11760

(MTMG); Frontenac Co., Mont Gosfors, *P. Maycock & A. Bouchard* 12796 (MTMG); Megantic Co. (Richmond Co.?), Asbestos, *R. Meilleur* 1022 (MTJB); Missisquoi Co., Philipsburg, *R. Meilleur* 1417 (MTJB); Portneuf Co., St. Augustin Lake, *Fr. Michel* 250 (MT); Portneuf Co., St. Raymond, *Fr. Michel* 1550 (MT); Quebec Co., Charlesbourg, *Fr. Michel* 2078 (MT); Gaspé-Est Co., Perce, *J. Mignault in 1929* (MT); Saguenay Co., Les Escoumains, *C. Morin* 862 (MT); Vaudreuil Co., Mt. Rigaud, *L. Newstrom* 722B (MTMG); Berthier Co., just S of Berthierville, *J. Op de Beeck & L. Gohier in 1969* (MTMG); Kamouraska Co., Lake Disparu, 31 mi. from St.-Anne, *R. Paquin & A. Payette* 178 (DAO); Matane Co., S end of Matane Lake, *J. H. Pierce & W. H. Hodge in 1934* (TRT); L'Islet Co., Trois Saumon Lake, *J. Perras* 71-202 (CAN); Gaspé-Est Co., Chandler, *T. Proulx in 1933* (MTMG, OSC, UBC, UC, UNB); Bonaventure Co., Grand Cascapedia, *C. Riley in 1934* (NY, WIS); Vaudreuil Co., Rigaud, *A. Robert* 656 (MT); Montcalm Co., Mont Tremblant Park, Rolland, *Fr. Rolland-Germain* 334 (DAO, MT); Montcalm Co., Mont Tremblant, *Fr. Rolland-Germain* 539 (CAN); Argenteuil Co., St. Adolphe, *Fr. Rolland-Germain* 7574 (ACAD, CAN, DAO, FSU, GH, MIN, MT, NY, TRT, UC, US); Terrebonne Co., St.-Hippolyte, *Fr. Rolland-Germain* 30207 (MT); Argenteuil Co., St.-Adolphe d'Howard, *Fr. Rolland-Germain* 36333 (DAO); Gaspé-Ouest Co., several mi. W of Mont St. Pierre, *G. B. Rossbach* 4453 (WVW); Gaspé-Ouest Co., SE of Ste. Anne des Monts, *G. B. Rossbach* 4454 (WVW); Terrebonne Co., Lake Mercier, *E. Rouleau* 2184 (MT); Terrebonne Co., Val David, *E. Rouleau* 2190 (MT); Portneuf Co., St. Augustin, *C. Rosseau & S. Payette in 1964* (UBC); Mistasini Terr., Chute-Cachee Bay, Dauphin Peninsula, *J. Rousseau & E. Rouleau* 1087 (B, CAN, GH, MT, NY); Rimouski Co., Bic, *J. Rousseau* 24916 (MT); Rimouski Co., Cap Errage, *J. Rousseau* 26502 (CAS, DAO, MT); Rimouski Co., Cap a L'Original, *J. Rousseau* 26734 (GH, MT, WS); Gaspé-Ouest Co., Mont Louis, *J. Rousseau* 31138 (DAO, GH, MT); Bonaventure Co., junction of Restigouche & Matapedia Rivers, *J. Rousseau* 32245 (GH); Anticosti Island, Riviere a la Chute, *J. Rousseau* 52398 (MT); Labelle Co., Nominique, *Fr. E. Roy* 2270 (MT); Saguenay Co., Tabatiere, Boishebert, *H. St. John* 90614 (CAN); Saguenay Co., Brouague, Petit R. Coxipi, *H. St. John* 90615 (CAN, GH); Bonaventure Co., Bonaventure, *Fr. Samuel* 49 (MT); Madeleine Islands, Ile aux Meules, *Fr. Samuel* 5018 (MT); Madeleine Islands, Il Havre aux Maisons, *Fr. Samuels* 5352 (MT); Gatineau Co., Aylmer, *H. S. Saunders* 99 (TRT); Argenteuil Co., Morin Heights, *H. Scoggan* 180 (CAN); Gatineau Co., Masham Twp, Johnston, *H. Senn et al.* 109 (DAO); Pontiac Co., Lochaber Parish, 2 mi. N of Silver Creek, *H. Senn & M. Zinck* 504 (DAO, MO); Gatineau Co., Gatineau Park, Eardley Parish, *H. Senn & M. Zinck* 646 (DAO); Pontiac Co., Aldfield Parish, *H. Senn et al.* 680 (DAO); Gatineau Co., Wakefield Parish, 4 mi. E of Wakefield, *H. Senn et al.* 851 (DAO); Gatineau Co., B'Ake Twp, 3 mi. E of Point Comfort, *M. Shchepanek & A. Dugal* 935 (CAN); Papineau Co., Portland W Twp, 3 mi. NE of Poltimore, *M. J. Shchepanek & A. Dugal* 982 (CAN); St.-Maurice Co., Pointe-du-Lac, *F. Stanislas* 565 (MT); Terrebonne Co., Lake Carre, *D. Swales* 5271 (MTMG); Gaspé-Ouest Co., Marsoui, *H. W. Swift in 1958* (DAO); Matane Co., ca. 1 mi. inland from river near Grosses Roches, *H. W. Swift in 1958* (DAO); Gaspé-Est Co., Dartmouth R., *B. Tache & A. Lepage* 253 (MT); Berthier Co., Lavaltrie, *L. M. Terrill* 902 (MTMG); Gaspé-Ouest Co., Mont St. Pierre, *L. Terrill* 2124 (CAN); Gaspé-Est Co., Bonaventure Island, *L. Terrill* 3229 (CAN); Temiscouata Co., Tobin, *L. Terrill* 5305 (CAN); Rouville Co., Yamaska Mt., *A. Walther in 1962* (MTMG); Rouville Co., Rougemont Mt., *A. Walther & A. Auclair in 1962* (MTMG); Brome Co., Brome Mt., Spruce Peak, *A. Walther & A. Auclair in 1962* (MTMG); Magdeleine Islands, Amherst Island, S Cape, *D. H. Webster & P. A. Bentley* 364 (ACAD); Matane Co., W of St. Edward de Mechins, *K. M. & M. C. Wiegand* 239 (CU); Bonaventure Co., New Carlisle, *E. Williams & M. L. Fernald in 1902* (GH); Deux-Montagnes Co., St. Scholastique, *R. Wishart in 1971* (MTMG); Stanstead Co., Hatley, *without collector* 9381 (GH); Sherbrooke Co., Ascot, *without collector in 1850* (MTMG). SASKATCHEWAN: Big Sandy Lake, NW end of Lake, *G. W. Argus & J. H. Hudson* 4466 (DAO); S end of Candle Lake, just N of Hayes Beach, *G. W. Argus* 4921 (DAO, RM); McKague, *A. J. Breitung in 1934* (DAO); N of Churchill R., near Windrum Lake, *W. Bryenton* 149 (CAN); Waskesiu Park, Waskesiu Narrows, *R. Connel in 1960* (SASK); White Fox, *G. E. Fraser in 1950* (SASK); Prince Albert National Park, Lake Waskesiu, *W. P. Fraser in 1930* (SASK); Turtle Lake, *W. P. Fraser in 1932* (SASK); Mistatim, *W. Haliday* 123 (CAN); Hidden Bay of Wolaston Lake, *V. L. Harms* 21595 (SASK); Saskatoon Dist., Sutherland, *J. H. Hudson* 2183 (DAO); vicinity of Wood Mt. Post, *J. H. Hudson* 2352 (COLO, DAO, SASK); Perdue, *J. H. Hudson* 3432 (USAS); Candle Lake Region, Candle Lake Road, *J. K. Jeglum* 689-62B (SASK); Saskatoon Dist., W side of Pike Lake, SW of Saskatoon, *L. Jenkins et al.* 1277 (DAO); S of Cherry Lake, 11 mi SE of Indian Head, *G. J. Jones & G. F. Ledingham* 738 (DAO, USAS); Sunny Brow, *I. Laycock s.n.* (DAO); 12 mi. S of Indian Head, below Big Spring, Cherry Lake, *G. F. Ledingham et al.* 147 (DAO, USAS); 3 mi. SW of Torch Lake, Candle Lake, *G. F. Ledingham & J. Hudson* 2141 (SMU, USAS); 20 mi. N of Regina, *G. F. Ledingham et al.* 5250 (USAS); Lac la Ronge, *G. F. Ledingham* 48425 (SMU, USAS); Paradise Hill, *M. M. Price* 55002 (DAO); E Bay, Dort Lake, *G. S. Riley* 48/3 (DAO); Lake Washesiu, *E. G. & R. C. Russell in 1932* (TRT); Indian Head, *B. J. Sallans in 1936* (TRT); Madge Lake, *C. Shaw* S-2761 (DAO); 0.4 mi. E of W gate to park at Madge Lake, *N. A. Skoglund* 536 (SASK); ca. 2 mi. W of Southend, Numaloin

Bay of Reindeer Lake, *J. Ternier & S. Lamont 599* (SASK); mi. 1.25 N of La Ronge on hwy 102, *J. Ternier & M. Jasieniuk 2096* (SASK); ca. 235 mi. N of La Ronge, Geikie R., mi. 116, hwy 105, *J. Ternier & M. Jasieniuk 2547* (SASK); Qu'Appelle Valley Region, E of Tantallon, *B. deVries 274* (DAO). ST. PIERRE & MIQUELON: St. Pierre, Etang Du Milieu, *L. Arsene 319* (NY); St. Pierre, Savoyard, *Le Gallo 447* (MT); St. Pierre, Langlade, Miquelon, *M. Le Hors s.n.* (DAO).

UNITED STATES. ALASKA: near Valdez, mile 10, Richardson Hwy, *T. Ahti 23904* (H); Valdez Township, ca. 4 mi. from Valdez along Prince William Sound's shore, *B. Cumby 269* (WILLI); Keystone Canyon, Valdez Road, *Dutilly et al. 21408* (RSA); Juneau, *J. Anderson 6315* (CAN, DAO, GH, MTJB, NO, NY, PH, RM, TEX), *F. Coville & T. Kearney, Jr. 2524* (GH, US), *W. Trelease 4439* (MO); mile 28 on road N from Juneau to Auke Bay, *P. Hoch 1812* (KYO, MHA, MO); Juneau, upper Gold Creek Canyon, *M. Williams 1932* (ORE, OSC); Sitka, *H. Cowles 1315* (MO, US), *L. Smith 101* (ORE, OSC), *A. Eastwood 951* (CAS); *W. Evans 231* (US); near Fairbanks, *L. Jordal 3518* (BH, US); ca. 138 mi. N of Fairbanks, *E. Scamman 327* (GH, MASS, US); Kodiak, Sitkalidak Island, *W. Eyerdam 36* (CAS, DS, GH, NY, UC, US); Kodiak Island Three Saints Bay, *B. Nybakken 2810* (WIS); Kiliuda Bay, *E. Beals in 1961* (WIS), Three Saints Bay, *W. Eyerdam 607* (CAS, DS, NY), Old Harbour, *W. Eyerdam 703* (CAN, CAS, US); Kodiak Islands, Raspberry Island, Port Vita, *W. J. Eyerdam 3871* (CAS, DAO, UC, WS); Circle Hot Springs, *H. Shacklette 6421* (US); Hot Springs area at Circle Hot Springs, *J. Taylor 3292* (OKL, SMU); Herendeen Bay, "Albatross" in 1890 (US); Skagway, *J. Anderson 847* (NY); Matanuska, *J. P. Anderson 1360* (CAN, POM); Seward, *L. Henderson 14893* (ORE), *L. I. & J. Grinnell 476* (CU); McDonald Lake, *J. Burcham 134* (US); Anchorage area, by Ship Creek, *C. York 326* (TEX); Hyder, *K. Whited 1289* (ND, UTC); Kenai Peninsula, Russian R. near junction with Kenai R., *S. L. Welsh & G. Moore 6018* (MIN, MISS, NY); Burrough's Bay, *Walker & Walker 1020* (CM, DS, GH, MO, RM, US); Prince of Wales Island, Klawak Lake, *Mr. & Mrs. E. P. Walker 1010* (CM, DS, GH, MO, NY, RM, US); Bell Island, Sulphur Springs, *Mr. & Mrs. E. P. Walker 953* (CM, DS, GH, MO, NY, RM, UC, US, WTU); Chichagoff Island, Ford Arm, *Mr. & Mrs. E. P. Walker 857* (CM, GH, MO, RM, US), 858 (DS, GH, MO, NY, RM, UC, WTU); Afognak Island, Discoverer Bay, *J. Taggart & C. Zabel 93* (UTC); Yakutat, *L. Stair in 1945* (PH); Admiralty Island, Hawk Inlet, *Mrs. F. M. Stephens in 1926* (CAS); 24 mi. SE of Whittier, *Eshamy, J. D. Solf 50* (WS, WTU); Kukak Bay, *Saunders 4443* (MO); Tanona R., Hot Springs, *A. & R. Porsild 656* (CAN, GH, US); Matanuska Valley, *L. Palmer 195* (NA); Bristol Bay District, Napnek, *I. L. Norberg in 1946* (SMU); Chichagof Island, Hoonah, *I. L. Norberg 247* (CAN, DS, GH, NY, US), Chignik, *I. L. Norberg in 1945* (CAN, GH); Glacier Bay National Monument, Muir Point, *M. G. Noble & C. D. Sandgren 400* (MIN); Yentna District, above Morgan Creek Flats, *R. V. Moran 66* (DS); 14 mi. N of Hyder, foot of Salmon R. Glacier, *T. T. McCabe 8521* (UC); Fox Bay, *D. Martel 146* (WS, WTU); Olga Bay, *E. & B. Loof 289* (BH, DAO, GH, ND, NY, OSC, TRT); Popof Island, *T. Kincaid in 1899* (US); Uyak, *W. Jepson 399* (UC, US); Hot Springs, *T. Howell 1626* (MIN, MO, NY, ORE, UC, US); Prince William Sound, beach of Passage Canal at Whittier, *A. M. Harvill 730* (UNA); Unga Island, *R. Grigas in 1918* (US); Revillagigido Island, Brushy Peak, *M. W. Gorman in 1890* (NDG); Yes Bay, *M. W. Gorman 24* (ORE, WTU); entrance of Disenchantment Bay, *F. Funston 76* (CAN, CU, GH, H, KANU, MO, NY, ORE, US); Chignik, *C. Flock in 1934* (DS); Cleveland Peninsula, Helm Bay, *J. Flett 1987* (US); Washington Bay, Kuiu Island, *W. Eyerdam 7358* (OSC), 7583 (ID); Knight Island, Thum Bay, *W. Eyerdam 3591* (NA); Wrangel, *W. Evans 97* (US); Katlian Bay, Tongass, *Mrs. J. C. Dort 41* (UC); Copper R. Delta, Eyak R. Trail, *J. H. Crow in 1965* (WS); Kukak Bay, *F. Coville & T. Kearney, Jr. 1620* (US); Sand Point, *L. Cole in 1941* (WIS); St. Paul Island, *L. Cole in 1941* (WIS); vicinity of Loring, *F. Chamberlain 102* (US); Trail to Santa Ana, *F. Chamberlain 39* (US); Kenai Peninsula, Mt. Marathon, Seward, *J. A. Calder 6368* (DAO, GH, UC); Ptarmigan Lake near Kenai Lake, *J. A. Calder 6037* (DAO, NY); Gustavus, Glacier Bay National Monument, Excursion Inlet, *D. B. Butts in 1962* (DS); Shumagin Islands, *D. Martel 147* (NY); Sitka, *J. Anderson 100* (US). ARIZONA: APACHE COUNTY, W of Greens Peak at C. C. Cabin, *Pinkava et al. L19170* (ASU), 8 mi. E of Nutrioso, Escudilla Mts., Milk Canyon, *K. F. Parker & E. McClintock 7511* (ARIZ, CAS, COLO, IA, ILL, MO, NY, OKLA, RSA, UC, US, WS), NE $\frac{1}{4}$ , Sec. 19, T7N, R27E, along Becker Creek, *C. E. Granfelt 70-180* (ARIZ), Apache Forest, Greer, *W. W. Eggleston 17151* (FSU, GH, NY, US). COLORADO: BOULDER COUNTY, 14 mi. NW of Boulder, *C. Bird 10871* (UAC), Peaceful Valley, Middle Street at C. C. Camp, *L. Bougere 1854* (SMU), S Boulder Canyon, *F. Ramaley 3854* (COLO); CLEAR CREEK COUNTY, Idaho Springs, 2.5 mi. E, *Johnston & Hedgcock 951* (RM); GILPIN COUNTY, Mts. near Golden, *E. L. Green in 1871* (NDG); LAKE COUNTY, near Leadville, *L. M. & N. T. Schedin s.n.* (RM); LARIMER COUNTY, 1 mi. S of Rustic, *P. Ginter 265* (NA), Moraine Park, *G. E. Osterhout 36518* (WIS), Estes Park, Thompson Canyon, *G. E. Osterhout 678* (NY, RM), Rocky Mountain National Park, Big Thompson Creek, *M. F. Colson 72-32* (COLO); PARK COUNTY, Estabrook, *J. P. Young in 1919* (CM, CU); TELLER COUNTY, Green Mt. Falls, *E. Bessey in 1895* (NY); COUNTY UNKNOWN, vicinity of Pine Grove, *C. S. Crandall 1360* (MONTU, NEB, US, WS), Dome Rock in Platte Canyon, *M. E. Jones in 1878* (IA, NA, NY, POM,

UTS). CONNECTICUT: FAIRFIELD COUNTY, Huntington, *E. H. Eames 5110* (NEBC); HARTFORD COUNTY, Southington, Savage Street, *C. Bissell in 1901* (GH, NY); LITCHFIELD COUNTY, 0.28 mi. W of rte 63 on Conn. rte 4, *D. E. Boufford & H. E. Ahles 18841* (KYO, MO), 1.2 mi. E of U.S. rte 7 on Conn. rte 4, *D. E. Boufford & H. E. Ahles 18838* (MHA, MO); MIDDLESEX COUNTY, Portland, *B. Chamberlain in 1924* (NY); NEW HAVEN COUNTY, New Haven, Mt. Carmel, *W. Safford 180* (US); NEW LONDON COUNTY, Ledyard, near Lantern Hill, *W. A. Setchell in 1887* (UC); TOLLAND COUNTY, Somers, *A. S. Pease 920* (NEBC); WINDHAM COUNTY, S Woodstock, *H. Dunslow in 1937* (NY). DISTRICT OF COLUMBIA: Washington, *F. Blanchard in 1892* (NY). IDAHO: BOUNDARY COUNTY, Mission Creek near Copeland, *J. H. Ehlers & C. O. Erlanson 375* (MICH), Brush Creek near Copeland, *J. H. Ehlers & C. O. Erlanson 284* (MICH); IDAHO COUNTY: Bitterroot National Forest, Macgruder Crossing on the Selway R., *J. H. Christ 12747* (NY). ILLINOIS: JO DAVIESS COUNTY, Warren, *L. M. Umbach in 1896* (MIN, PH); KANE COUNTY, Elgin, *G. Vasey s.n.* (ILL); LAKE COUNTY, Lake Bluff, *E. J. Hill 42, 1908* (ILL). INDIANA: ALLEN COUNTY, ca. 8 mi. SW of Fort Wayne, *C. C. Deam 50211½* (IND, WIS); LAGRANGE COUNTY, ca. 3 mi. SE of Mongo, *C. C. Deam 50702* (IND); LAPORTE COUNTY, 0.5 mi. E of Andry stop on S Shore Traction Line, *C. C. Deam 31453* (IND); MONTGOMERY COUNTY, along Sugar Creek near the "Shales," *C. C. Deam 9332* (IND); PORTER COUNTY, Tamarack stop on the S Shore Electric Line, *C. C. Deam 8816* (IND); STEUBEN COUNTY, 0.5 mi. E of Bass Lake, *C. C. Deam 1281* (IND, MIN, UC, US). IOWA: ALLAMAKEE COUNTY, Village Creek, Center Township, *T. G. Hartley 7632* (RSA); CLAYTON COUNTY, around Ice Cave, Bixby State Park, *J. H. Schaffner in 1933* (OS); DUBUQUE COUNTY, Liberty Township, 2 mi. W, 2 mi. N of Luxemburg, *L. Smith 9903* (ISC, TEX); MUSCATINE COUNTY, Wild Cat Den, *L. H. Pammel & F. Reppert 1873* (MIN); WINNESHIEK COUNTY, Bluffton, *W. L. Tolstead in 1933* (COLO, NEB, PAC, UC). KENTUCKY: EDMONSON COUNTY, Pine Hollow, ca. 1 mi. from Poplar Springs Church, *K. A. Nicely 1979* (NCSC, NCU); LETCHER COUNTY, Bad Branch, Pine Mt., *E. L. Braun 566* (NY, US), Partridge, Cumberland Valley, *E. L. Braun 1093* (GH, US). MAINE: ANDROSCOGGAN COUNTY, E Auburn, *E. D. Merrill 363* (NEBC); AROOSTOOK COUNTY, ca. 0.25 mi. from Ludlow town line in Houlton, *R. M. Downs 2350* (NCSC), Fort Fairfield, *M. L. Fernald in 1893* (NEBC), St. Francis, *M. L. Fernald in 1893* (NEBC), Monticello, *M. L. Fernald & B. Long 14211* (MO, NEBC, PH), Fort Kent, *K. K. Mackenzie 3357* (NY, US), Aroostook R., T9, R7, *E. Ogden & G. Chamberlain 2649* (US), St Johns R., 3 mi. SE of Van Buren, *G. B. Rossbach 5510* (NCU, WVW), Presque Isle, *F. C. Seymour 23278* (NEBC); CUMBERLAND COUNTY, Westbrook, *P. Ricker 269* (US); FRANKLIN COUNTY, Greenvale, Rangely Lake region, *K. Furbish in 1894* (NEBC), Phillips, valley of Sandy R., *K. Furbish in 1894* (NEBC), Madrid, *C. H. Knowlton in 1917* (PH), Day Mt., Arm Township, *C. D. Richards 5361* (ACAD); Hancock County, Morrison's Campground, E Swan Island, *G. B. Rossbach 6872* (WVW); KENNEBEC COUNTY, E Winthrop, *N. C. Fassett 15841* (KYO); KNOX COUNTY, SE part of Sheep Island, Muscle Ridge, *G. B. Rossbach 3820* (NCU); LINCOLN COUNTY, Ocean Point, *N. C. Fassett 3561* (DUKE, WIS, WS); OXFORD COUNTY, Bowmantown Township, *J. Carter 643* (NHA); Mason, Pickett Henry or Pine Mt., *A. R. Hodgdon & F. S. Steele 10743* (NEBC), Hartford, *J. Parlin in 1885* (NEBC), NW Bethal, Besse Mt., *L. Wheeler 572203* (NEBC), 5 mi. NW of Andover, *R. True 1544* (PENN); PENOBSCOT COUNTY, Clifton, *F. P. Briggs 1483* (RM), Orono, *M. L. Fernald in 1888* (NEBC), Patten, *M. L. Fernald in 1897* (NEBC), near McLeod's, *M. L. Fernald in 1900* (GH, NEBC, PH), Charleston, *O. Knight in 1905* (NMC, NY), Mt. Harris, S Dixmont, *G. B. Rossbach 2099* (ACAD), junction of Hwy 95 and the Penobscot R., *C. L. Rodgers 73671* (FUGR); PISCATAQUIS COUNTY, Dover, *G. Fernald in 1896* (NEBC), Abbot, *M. L. Fernald & B. Long 14212* (NEBC, PH, US), Mt. Katahdin, Chimney Pd, *H. N. Moldenke 19069* (CAN, MT, NCSC, NY, OSC, WTU), SE end of Chamberlain Lake, *G. B. Rossbach 6485* (ACAD), Greenville, Upper Wilson Pd, *E. Walker 159* (MIN, PENN); SOMERSET COUNTY, Cambridge, *F. Bunker in 1873-8* (NEBC), S of Pleasant Pd, *J. Collins & E. Chamberlain* (NEBC), Norrdgewok, Wilder Farm, *D. S. Conant 3359* (CM, KYO, MHA, MO), Seabrook, St. Johns Pd, *D. Hamm 1853* (NEBC), 10 mi. W of Newport on Hwy 2, *C. L. Rodgers 73634* (FUGR), Baker Lake, T7, R17, *H. St. John & G. Nichols 2398* (CAN, NEBC, NY, US); WALDO COUNTY, Dark Harbor, Islesboro, *F. T. Hubbard in 1897* (FSU, LL, NCU, SMU); WASHINGTON COUNTY, E Machias, *M. Barber in 1898* (NEBC), Cherryfield, *S. F. Blake 4015* (LL), Calais, *M. L. Fernald 2010* (GH, MT, NEBC), Cutler, *K. Furbish in 1902* (NEBC); YORK COUNTY, Kennebunk, *F. C. Seymour 5633* (DUKE, NDA, WIS). MARYLAND: CAROLINE COUNTY, Oakland, *H. N. Twing in 1886* (MIN); GARRET COUNTY, Swallow Falls, *F. Shreve 557* (US). MASSACHUSETTS: BARNSTABLE COUNTY, Sandwich, Spring Hill, *M. L. Fernald & B. Long 18848* (CU, NEBC, NYS, PH); BERKSHIRE COUNTY, 6.1 mi. S of the junction of Mass. Rtes 8 & 123 on 8, *D. E. Boufford & H. E. Ahles 18843* (MO), Cheshire Game Management Area off Wells Road, *H. E. Ahles 75945* (DS); BRISTOL COUNTY, New Bedford, *E. Hervey s.n.* (NEBC); ESSEX COUNTY, Boxford, *F. Hunnewell 8878* (NEBC); FRANKLIN COUNTY, Deerfield, *R. G. Poland in 1954* (MISS); HAMPDEN COUNTY, Granville, Bad Luck Mt., *F. C. Seymour 360* (DUKE, GH, MO, NY); HAMPSHIRE COUNTY, Middlefield, *M. L. Fernald & B. Long 10067* (NEBC, PH); MIDDLESEX COUNTY, Sherborn, "The Narrows," *F. Hunnewell 6782* (NEBC); NORFOLK COUNTY, Needham, Washburn's Pines, *T. Fuller in 1892* (NEBC); WORCESTER COUNTY, Stur-

bridge, *D. Comins* in 1930 (NEBC), Petersham, *D. S. Correll & T. Steiger* 11201 (DUKE). MICHIGAN: ALGER COUNTY, Miner's Falls, *J. C. Myers* 199 (WVA); ALLEGAN COUNTY, Macatawa, *C. Mell* 169 (US); ANTRIM COUNTY, Torch Lake, *H. E. Sargent* 5828? (MICH); ARENAC COUNTY, ca. 4.5 mi. NW of Omer, *E. G. Voss* 4649 (MICH); BARAGA COUNTY, Big Limestone Mt., L'Anse, *N. C. Fassett* 21039 (WIS); BENZIE COUNTY, Benzonia Township, *V. Weadock* 94 (MICH); BERRIEN COUNTY, Warren Woods, *B. C. Billington* in 1919 (MICH); CASS COUNTY, Silver Creek District, *H. S. Pepoon* 1442 (MICH); CHEBOYGAN COUNTY, vicinity of Douglas Lake, *H. A. Gleason & H. A. Gleason, Jr.* 34 (GH, ISC, NY, SMU, WVA); CHIPPEWA COUNTY, Chase S. Osborn Preserve of Univ. of Michigan, *R. McVaugh* 8776 (DS, MICH, NCSC); CLINTON COUNTY, Hubbardston, *C. F. Wheeler* in 1878 (KSC); CRAWFORD COUNTY, vicinity of Grayling, *C. Piper* in 1922 (US); DELTA COUNTY, 4 mi. NE of Nahma, *R. McVaugh* 10936 (MICH); DICKINSON COUNTY, ca. 5.5 mi. NNE of Ralph, *E. G. Voss* 9945 (MICH); EMMET COUNTY, N of Idlewild, *J. A. Nieuwland* in 1932 (ND); GENESEE COUNTY, Flint, *D. Clarke* in 187? (US); GOGEBIC COUNTY, Black River, *C. D. Richards* 3427 (ACAD); GRAND TRAVERSE COUNTY, ca. 10 mi. SE of Traverse City, *J. V. A. Dieterle* 1352 (MICH); GRATIOT COUNTY, about Alma, *C. A. Davis* in 1892 (WS); HOUGHTON COUNTY, N of Chassell, *C. D. Richards* 1965 (DAO); IONIA COUNTY, Hubbardston, *E. Smith* 25 (US); IOSCO COUNTY, NW of Oscoda, *G. A. Loughridge* 4201 (DAO); IRON COUNTY, ca. 1 mi. SE of Elmwood, *E. G. Voss* 7695 (MICH); JACKSON COUNTY, *S. H. & D. R. Camp* in 1896 (MIN); KENT COUNTY, Cedar Springs, *C. W. Fallan* in 1896 (MIN); KEWEENAW COUNTY, Isle Royale, Duncan Bay, *W. S. Cooper* 236 (GH, MIN); LEELANAU COUNTY, ca. 1 mi. NW of Tamarack Lake, *E. G. Voss* 5119 (MICH); LUCE COUNTY, shore of Lake Superior just W of Deer Par, *R. L. Stuckey* 1142 (OS); MACKINAC COUNTY, ca. 0.5 mi. NE of Brevoort, *R. McVaugh* 9380 (MICH, MT); MACOMB COUNTY, Washington, *O. Farwell* 6204a (GH); MANISTEE COUNTY, Manistee, *F. P. Daniels* in 1900 (UMO); MARQUETTE COUNTY, Turin, *B. Barlow* in 1901 (GH, US); MENOMINEE COUNTY, edge of Creek in County Park, *G. Gressl* 2654 (NY); MUSKEGAN COUNTY, Lake Harbor, *W. S. Moffat* in 1896 (ILL); NEWAYGO COUNTY, Hidden Lake, *C. M. Bozur* 3481 (MICH); OAKLAND COUNTY, Rochester, *O. Farwell* 3814½ (GH); OCEANA COUNTY, Benona Township, *J. G. Lacy & S. G. Gumina* 77018 (MICH); OSCODA COUNTY, ca. 4 mi. NE of Mio, *C. B. Nimke* 798 (MICH); OTTAWA COUNTY, Pigeon Lake, *J. A. Nieuwland* in 1918 (MT, ND); ROSCOMMON COUNTY; Prudentville, *R. Driesbach* 5197 (PH); SAGINAW COUNTY, 5 mi. N of county line, Flint-Saginaw Road, *R. Driesbach* 5087 (PH); ST. CLAIR COUNTY, near Port Huron, *C. K. Dodge* in 1896 (ND, TENN, UC); SCHOOLCRAFT COUNTY, near Floodwood, *C. K. Dodge* in 1915 (MICH); WASH-TENAW COUNTY, Ann Arbor, *S. M. Manning* in 1885 (MIN); WAYNE COUNTY, Detroit, *L. Foote* in 1870 (MICH). MINNESOTA: AITKIN COUNTY, 2 mi. E of Tamarack, *J. W. Moore & F. K. Butters* 13507 (MIN); ANOKA COUNTY, 8 mi. E of Bethel in Cedar Creek area, *V. L. Malone* 44 (MIN); BECKER COUNTY, Detroit Lakes, *O. A. Stevens* in 1933 (CM, DS); BELTRAMI COUNTY, Black Duck, *Mrs. R. Westley* in 1918 (ISC), Cass Lake, Squaw Point, *E. L. Nielsen* 79 (MIN); BLUE EARTH COUNTY, Madison Lake, *E. P. Sheldon* in 1891 (MIN, NY); CARLTON COUNTY, Thompson, *J. H. Sandberg* 417 (ARIZ, KSC, MIN, NEB); CASS COUNTY, Lake Kilpatrick, *C. A. Ballard* in 1893 (MIN, RM, WIS), 14 mi. W. 3 mi. N of Remer, *S. Stephens & R. Brooks* 41977 (KANU, MASS), Gull Lake, *A. P. Anderson* A630 (MIN); CHISAGO COUNTY, Center City, *B. C. Taylor* T1377 (MIN, RM, US, WS); CLEARWATER COUNTY, Itasca State Park, near Nicolet Lake, *C. R. Janssen* 138 (KYO); COOK COUNTY, E end of Mountain Lake, *F. K. Butters* 88 (NY), along portage from Alder to E Bearskin Lake, *F. K. Butters & M. F. Buell* 476 (GH, MIN, NY, US), Sawbill Lake, T62N, R4W, *J. DeQ & M. W. Briggs* 68 (MIN), ca. 1 mi. N of Mineral Center, *F. R. & J. S. Benner* 657 (MIN), Kimball Lake Campground, *E. Loula* 14 (MIN), Grand Portage, *P. A. Rydberg* 9683 (NY); CROW WING COUNTY, Garrison Township, W side of Chandler Lake, *J. W. & M. F. Moore* 256 (MIN); DOUGLAS COUNTY, 1 mi. NE of Spruce Center, *C. R. Sperling* 359 (NDA); HENNEPIN COUNTY, Deephaven, Minnetonka, *C. O. Rosendahl* 1271 (MIN); HOUSTON COUNTY, Sec. 16, Mayville Township, *F. K. Butters & C. O. Rosendahl* 3935 (MIN); HUBBARD COUNTY, *R. Bebb* 4754 (MO, OKL, OKLA, SMU); ISANTI COUNTY, W of the Lindgren Farmstead, *J. W. Moore & F. B. Abeles* 25192 (MIN); ITASCA COUNTY, hwy 6, 4 mi. S of the junction with the road from Big Fork, *J. W. Moore & R. B. Hall* 16772 (DAO, MIN), between Cut Foot Sioux and Inger, *A. Johnson* 3228 (PH), ca. 8.5 mi. SW of Grand Rapids, *G. A. Wheeler & P. H. Glaser* 2008 (DUR), Bowstring, *H. E. Stork* 1214 (MIN); KOOCHICHING COUNTY, Rainy Lake, E side of Tilson Bay, *J. W. & M. F. Moore* 11840 (MIN); LAKE COUNTY, Sec. 20, T64N, R10W, *C. Ahlgren* 159 (MIN, TRT), ca. 14 mi. W of Finland, near S end of Cloquet Lake, *E. G. Voss* 10065 (MICH, MIN, VDB), inlet to Moose Lake Canadian Border Lodge, *O. Lakela* 16513 (DUL, MIN), Superior National Forest, Quetico-Superior Wilderness, *W. L. Baxter* in 1956 (DAO), Upper Manitou Falls, *G. & F. Ownbey* 977 (H, NY), 5 mi. E of Two Harbors, *H. A. Gleason* 9557 (NY); LAKE OF THE WOODS COUNTY, Lake of the Woods, 3 mi. S of Rocky Point, *C. O. Rosendahl et al.* 7016 (MIN), Angel Inlet, *J. W. & M. F. Moore* 11101 (MIN); MAHNOTOMEN COUNTY, Oakland Township, *M. Partch* in 1958 (MIN); MILLE LACS COUNTY, Milaca, *E. P. Sheldon* in 1892 (MIN, RM, WIS); OTTERTAIL COUNTY, 3 mi. N of Battle Lake, *P. Johnson* 538 (GH, IA, NY, UMO), Dora Township, between Dillers Pd and Star Lake, *P. Jones* 374 (GH);



Pine County, near the NE corner of St. Croix State Park, *J. W. Moore & N. L. Huff 18083* (MIN); ROSEAU COUNTY, Roseau, *W. E. Manning in 1923* (CM); ST. LOUIS COUNTY, Duluth, *O. Lakela 2579* (MIN, MO, OKLA, SMU, UC), Anttila Farm, Palo, *O. Lakela 2621* (DUL, MIN, WS), Kabetogama Lake, Pine Island, *O. Lakela 14958* (DUL, MIN); STEARNS COUNTY, Collegeville, *P. E. Kuehne in 1933* (DAO); WRIGHT COUNTY, "Big Woods" W of Delano, *F. K. Butters & C. O. Rosendahl 3349* (MIN). MONTANA: FLATHEAD COUNTY, Glacier National Park, Avalanche Campground, *L. H. Harvey 5183* (MONTU), Mt. Cannon above McDonald Creek, *L. H. Harvey 6064* (NCU), W side of Glacier National Park, *W. McCalla 3784* (ALTA), 1 mi. S of Columbia Falls, *H. T. & J. M. Rogers 1234* (MO, NY, WS, WTU), Big Fork, *Mrs. J. S. Clemens in 1908* (CAS); GALLATIN COUNTY, Bozeman & vicinity, Spring Hill, *J. Blankinship in 1905* (MONTU), Bozeman, Leverich Canyon, *W. E. Booth in 1956* (DAO, RM, WTU); GRANITE COUNTY, Rock Creek Canyon, *C. L. Hitchcock & C. V. Muhlick 14394* (WTU); LAKE COUNTY, T23N, R18W, Sec. 24, *J. R. Habeck in 1962* (WTU), Flathead Lake, Swan Lake, *M. E. Jones 8402* (MONTU), Flathead Lake, *A. W. L. Bray in 1914* (OS); LEWIS & CLARK COUNTY, Blue Cloud near Helena, *F. Kelsy 546* (NY); MISSOULA COUNTY, ca. 12 mi. from mouth of Miller Creek Canyon, *C. L. Hitchcock 1772* (MONTU, POM), Lolo, near Woodman, *J. Kirkwood 1216* (MICH, MONTU, ORE, UC), 5 mi. NW of St. Regis Junction, *K. M. Wiegand et al. 1747* (CU), Missoula, Marshall Gulch, ? *in June 1915* (DS, ISC); RAVALLI COUNTY, Bitterroot Mts. off lower St. Mary's Road, *K. H. Lakschewitz 5124* (COLO); ROSEBUD COUNTY, First Lake, E Rosebud R., *P. Hawkins in 1921* (WIS). NEW HAMPSHIRE: BELKNAP COUNTY, Gilmanton, *J. Cushman & S. Sanford 1220* (LL, NEBC); CARROLL COUNTY, Madison, *A. R. Hodgdon et al. 9598* (UNA); CHESHIRE COUNTY, town of Chesterfield, "The Gulf," *D. E. Boufford 18855* (C, G, KYO, MHA, MO, PE); COOS COUNTY, Lancaster, *A. S. Pease 14328* (NEBC), Pittsburg, Norton Pool at E Inlet, *A. R. Hodgdon & P. Allen 18302* (NHA); GRAFTON COUNTY, Hanover, *H. Barss in 1910* (OSC); HILLSBOROUGH COUNTY, Newburg, Mt. Sunapee, *F. B. Rousseau 1722* (MO); ROCKINGHAM COUNTY, Raymond, *A. R. Hodgdon & R. Leighton 5767* (NEBC); STRAFFORD COUNTY, Rollinsford, *A. R. Hodgdon 11910* (NEBC); SULLIVAN COUNTY, 6.9 mi. E of Grantham, *H. E. Ahles 68466* (MASS). NEW JERSEY: MORRIS COUNTY, 3 mi. S of Melton, *C. Williamson in 1905* (PH); SUSSEX COUNTY, Sparta Glen, *K. K. Mackenzie 4221* (MO, NY, US); WARREN COUNTY, 0.5 mi. NE of Uniontown, *R. Shaeffer, Jr. 44375* (US). NEW MEXICO: Catron County, Mogollon Mts., on or near the W Fork of the Gila R., *O. B. Metcalfe 516* (ARIZ, GH, ILL, MASS, MIN, MO, NDG, NMC, NY, RM, US). NEW YORK: ALBANY COUNTY, E. N. Huyck Preserve, Rensselaerville, *N. H. Russell 6255419* (IA, TENN); CATTARAUGUS COUNTY, Conewango, *E. Anderson & R. Woodson, Jr. 816* (MO); CAYUGA COUNTY, Conquest, NE end of Duck Lake, *L. H. MacDaniels 6934* (CU); CHATAUQUA COUNTY, Forestville, *E. A. Southworth in 1885* (MICH); CHEMUNG COUNTY, Laurel Hill, *S. J. Smith 460* (CU); CHENANGO COUNTY, Norwich, *M. H. Fitch in 1890* (POM); COLUMBIA COUNTY, Cofake Mt. Alander, *R. McVaugh 1775* (PENN); DELAWARE COUNTY, vicinity of N Harpersfield, *D. Topping 184* (US); DUTCHESS COUNTY, North East, N of Mt. Brace summit, *H. D. House 24827* (NY); ERIE COUNTY, E of Gowanda, *W. C. Muenscher 15801* (CU); ESSEX COUNTY, near Newcomb, *H. D. House 9117* (CAS); FULTON COUNTY, Casoga, *H. Dunslow in 1932* (NY); FRANKLIN COUNTY, Pinehurst, *K. Guest 257* (PENN); GENESEE COUNTY, Berger Swamp, *W. C. Muenscher & B. I. Brown 21370* (CU); GREENE COUNTY, near Hunter, *N. L. Britton in 1898* (NY); HAMILTON COUNTY, 0.9 mi. SW of Bear Brook, *G. H. M. Lawrence & W. J. Dress 385* (BH, DAO); HERKIMER COUNTY, Little Moose Lake, *S. van Pelt in 1906* (PH); JEFFERSON COUNTY, Pierrepont, *O. Phelps 716* (GH, US); LEWIS COUNTY, NW of Rector, *N. Hotchkiss 206* (NYS); MADISON COUNTY, Valley Mills, *H. D. House 1153* (MO, US); MONROE COUNTY, Ontario lowlands N of Webster, *W. A. Matthews 4166* (NCU, UC); NIAGRA COUNTY, Wilson, *A. D. Pease 893* (DAO); ONEIDA COUNTY, White Lake R. *McVaugh 32* (PENN); ONONDAGA COUNTY, Syracuse, *M. L. Overacker in 1889* (KSC); ONTARIO COUNTY, Canadaigua, *E. J. Durand in 1892* (MIN); ORANGE COUNTY, Greenwood Lake, *J. Schrenk in 1876* (CU); ORLEANS COUNTY, Oak Orchard, *S. Flirham in 1897* (BH); OSWEGO COUNTY, Volney, *L. M. Howard in 1916* (CU); OTSEGO COUNTY, along Summit Lake, *W. C. Muenscher & O. F. Curtis, Jr. 5259* (CU); RENSSELAER COUNTY, S of Petersburg Pass, *H. D. House 21634* (CU, NY, PENN); ST. LAWRENCE COUNTY, Hopkinton, Fort Jackson, *L. Harper in 1932* (CU); SARATOGA COUNTY, S of Wilton, *H. D. House 29873* (TEX); SCHOHARIE COUNTY, Sharon Springs, *M. Brandegee s.n.* (UC); SCHUYLER COUNTY, Walkins Glen, *A. J. Eames 2928* (CU); SENECA COUNTY, Duck Lake, near N end of Cayuga Lake, *P. A. Munz 756* (POM); SULLIVAN COUNTY, Ten Mile R., *W. A. Weber 1054* (COLO); STEUBEN COUNTY, W side of Waneta Lake, *R. T. Clausen 1369* (BH, UC); TIOGA COUNTY, Richford, NE of Caroline, *A. Gershoy 10509* (CU); TOMPKINS COUNTY, Slaterville, along Six Mile Creek, *G. H. M. Lawrence 463* (KY, WTU); ULSTER COUNTY, Hwy 28 between Big Indian & Shandaken, *E. Haber 661* (TRT); WARREN COUNTY, 3 mi. N of Luzerne, *M. Tees in 1936* (PH); WASHINGTON COUNTY, between hills of Pilot Knob-Sugar Loaf Mt. range, *W. T. Winne in 1941* (B, GA, ISC, OSC, UARK); WAYNE COUNTY, E of Clyde, *F. P. Metcalf 8525* (CU, GH); WESTCHESTER COUNTY, 2-3 mi. below Bedford, *W. Pennell 7122* (PH); WYOMING COUNTY, Gainesville, *D. S. Jordan in 1870* (CU); YATES COUNTY, Five Mile Swamp, Five Mile Creek, *W. C. Muenscher 23592* (CU). NORTH CAROLINA: ASHE

COUNTY, near N Fork New R., Bins, *A. E. Radford 38574* (NCU); AVERY COUNTY, in balsam grove on Roan Mt., *M. L. Smyth 3152* (VPI); BUNCOMBE COUNTY, Craggy Mountain, *Biltmore Herb. 1967b* (GH, ISC, MICH, MIN, MO, NCSC, NCU, NY, NYS, OS, TUR, US, VT, W); CLAY COUNTY, Perry Gap Road 2.7 mi. N of U.S. 64, *J. Massey et. al. 4712* (NCU, WCUH); GRAHAM COUNTY, Joyce Kilmer Memorial Forest, *W. C. Coker & L. M. Stewart in 1939* (NCU); HAYWOOD COUNTY, Mt. Sterling, *D. C. Bain & H. M. Jennison 1097* (TENN); JACKSON COUNTY, Rough Butt Bald Mt., *G. S. Ramseur 241* (CM); MACON COUNTY, Highlands, Dry Falls, *E. Quarterman 981* (VDB); MADISON COUNTY, 3.5 mi. SE of Trust on N.C. 36, *H. E. Ahles & J. A. Duke 46483* (DAO, NCU, VDB); MCDOWELL COUNTY, near Big Craggy on the Blue Ridge Parkway, *C. R. Bell 4440* (FSU, GA, NCU); MITCHELL COUNTY, Roan Mt., fir forest, *A. E. Radford 45000* (AUA, CM, DAO, DHL, FSU, FUGR, GA, GAS, GH, H, IND, ISC, KE, KY, LL, LYN, MISS, NCU, NDA, NY, OSC, PAC, RSA, SMU, STAR, TENN, TEX, TRT, UARK, UBC, UC, UNA, UNCC, US, VDB, VSC, WCUH, WILLI, WIS, WVA); SWAIN COUNTY, near Leatherman's Gap, *A. E. Radford 6420* (PAC, SMU, US); TRANSYLVANIA COUNTY, NE slope of Fryingpan Mt., *O. M. Freeman 57590* (NCU, VPI); WATAUGA COUNTY, Sim's Trail near Blowing Rock, *M. L. Smyth 2546* (VPI); YANCEY COUNTY, Balsam Gap, W of the Blue Ridge Parkway, *W. B. Fox 5011* (BHO, NCSC, PH, SMU). NORTH DAKOTA: BARNES COUNTY, Kathryn, *H. F. Bergman 2285* (CAN, MIN, NDA); BENSON COUNTY, Pleasant Lake, *J. Lunell in 1912* (MIN, NY, SDU, US); PEMBINA COUNTY, Walhalla, *O. A. Stevens 257* (DAO, GA, MT, NDA, NY, OKL, SMU, UC, WIS); ROLETTE COUNTY, Turtle Mts., *O. A. Stevens in 1942* (NDA). OHIO: ALLEN-VAN WERT COUNTIES, Delphos, *H. Young in 1884* (GH); ASHTABULA COUNTY, Mohican State Forest, Hanover Township, *T. S. Cooperrider 8283* (KE); ASHTABULA COUNTY, 2 mi. WSW of Windsor, *T. S. Cooperrider 8567* (KE); CLARKE COUNTY, Springfield, *Mrs. E. J. Spence in 1879* (OS); COLUMBIANA COUNTY, Yellow Creek Township, *T. S. Cooperrider & B. Hoffman 6381* (KE); COSHOCTON COUNTY, White Eyes Township, *A. W. Cusick 5819* (KE, NCU); CUYAHOGA COUNTY, Cleveland, *W. Krebs & E. Claassen in 1890* (OS); ERIE COUNTY, Florence Township, *E. L. Moseley in 1898* (US); FRANKLIN COUNTY, Worthington, *A. Horr s.n.* (ISC); GEauga COUNTY, Bainbridge Township, *T. S. Cooperrider & E. Hauser 8531* (KE); HOCKING COUNTY, Gibsonville, *J. D. & W. A. Wistendahl 742* (BHO); HOLMES COUNTY, Washington Township, *T. S. Cooperrider 8131* (KE); HURON COUNTY, Olena, *O. E. & G. K. Jennings in 1906* (CM); JACKSON COUNTY, Liberty Township, *F. Bartley in 1969* (BHO); JEFFERSON COUNTY, Island Creek Township, *A. W. Cusick 8193* (KE); KNOX COUNTY, Jefferson Township, *P. L. Pusey 623* (KE, OS); LAKE COUNTY, near Painesville, *W. C. Werner 6068* (OS); LORAIN COUNTY, Oberlin, *A. E. Ricksecker in 1894* (OS, US); MEDINA COUNTY, 1.5 mi. E of Sharon Center, *T. S. Cooperrider & E. Herrick 7487* (KE); MORGAN COUNTY, Fairfield Township, *G. M. Silberhorn 4548* (KE); PORTAGE COUNTY, Freedom Township, *A. N. Rood & R. J. Webb 145* (KE); SUMMIT COUNTY, Twinsburg, Crown Hill Memorial Park, *E. M. Herrick in 1955* (OS); TRUMBULL COUNTY, Mesopotamia Township, Casey's Spring, *D. E. Boufford 18820* (KYO, MHA, MO). PENNSYLVANIA: ALLEGHENY COUNTY, 1 mi. W of Glenshaw, *O. E. Jennings 6250* (CM); BEDFORD COUNTY, 0.5 mi. WSW of Wolfsburg, *D. Berkheimer 20262* (CM); BERKS COUNTY, 2.12 mi. W of Wernersville, *D. Berkheimer 2120* (CM); BLAIR COUNTY, 5.2 mi. N of Tipton, *W. E. Buker in 1972* (CM); BRADFORD COUNTY, 13 mi. E of Canton, *W. F. Westerfeld 938* (CM, PAC, PH); BUTLER COUNTY, 2 mi. N of Slippery Rock, *O. E. Jennings in 1922* (CM); CAMBRIA COUNTY, 1.3 mi. W of Nicktown, *L. K. Henry & W. E. Buker in 1954* (CM); CAMERON COUNTY, 5 mi. NW of Emporium, *J. M. Fogg et al. 20212* (CM); CARBON COUNTY, in Glen Onoko, *H. W. Pretz 1965* (NY, PH, VPI); CENTRE COUNTY, Bear Meadows, *L. K. Henry & W. E. Buker in 1950* (CM); CLARION COUNTY, valley of river at Clarion, *O. E. Jennings in 1921* (CM); CLEARFIELD COUNTY, N Gerard Township, *L. K. Henry in 1941* (CM); CLINTON COUNTY, Lamar Township, *D. E. Boufford 18830* (BM, CM, G, GH, K, KYO, LD, MHA, MO, P, PE, S, UC); COLUMBIA COUNTY, North Mts. above Ricket's, *H. Meredith in 1920* (PH); CRAWFORD COUNTY, Conneaut Lake, *J. A. Shafer 275* (CU, ISC, MICH, MT, NCU, NDA, NLU, OKLA, PH, UC, US); DAUPHIN COUNTY, 2.5 mi. SSE of Enterline, *D. Berkheimer 14702* (PAC, PENN); ELK COUNTY, Spring Creek Township, *A. N. Rood & W. Simon 641* (KE); ERIE COUNTY, LeBoeuf Lake, *L. K. Henry & W. E. Buker in 1953* (CM); FAYETTE COUNTY, Ohiopyle, *P. Ricker 1223* (US); FOREST COUNTY, ca. 2 mi. S of Duhring, *L. K. Henry in 1955* (CM); FRANKLIN COUNTY, 3 mi. W of Roxbury, *E. Earle 2715* (PENN); HUNTINGDON COUNTY, Owl's Hollow, *T. C. Porter in 1878* (PH); INDIANA COUNTY, 2 mi. above Chambersville on rte 110, *L. K. Henry in 1941* (CM); JEFFERSON COUNTY, Sigel Township, *D. E. Boufford 18826* (KYO, MO, PE); LACKAWANNA COUNTY, 0.5 mi. W of Dalton, *S. L. Glowenke 8528* (MIN); LANCASTER COUNTY, *J. Galen 893* (CAS); LAWRENCE COUNTY, near Eckert's Bridge, Slippery Rock Creek, *H. W. Graham in 1923* (CM); LEBANON COUNTY, 2.5 mi. SE of Millbach, *H. Wilkens 8292* (PENN); LEHIGH COUNTY, Bethlehem, Lehigh Mt., *J. Wolle in 1841* (CM); LYCOMING COUNTY, 2 mi. WNW of Waterville, *E. T. Wherry in 1946* (PH); MCKEAN COUNTY, Mt. Jewett, *O. E. Jennings in 1922* (CM); MERCER COUNTY, 2 mi. NE of Grove City, *O. E. Jennings in 1940* (CM); MIFFLIN COUNTY, Otter Gap, *L. Overholts & H. Popp in 1922* (PAC); MONROE COUNTY, ca. 1.5 mi. SE of Mt. Pocono, *E. C. Earle 1113* (TENN); NORTHAMPTON COUNTY, Bangor (Greenwold), *C. Bachman in 1908* (PH); PIKE COUNTY, Beaver Dam, "Hunting

Tower," *S. Brown & C. Saunders in 1899* (PH); POTTER COUNTY, rte 144 near Ole Bull State Park, *W. E. Buker in 1965* (CM); SCHUYLKILL COUNTY, 1.5 mi. W of Snyders, *P. Wagner 4677* (PENN); SNYDER COUNTY, 3 mi. NNE of Troxelville, *Wade & Wade 1343* (PENN, WIS); SOMERSET COUNTY, ca. 2 mi. NW of Springs, *L. K. Henry in 1968* (CM); SULLIVAN COUNTY, Ganoga Glen, *H. W. Pretz 3931* (VPI); SUSQUEHANA COUNTY, 2 mi. NW of Elkdale, Elk Mt., *R. H. True 4108* (CM); TIOGA COUNTY, Leonard Harrison State Park, *L. K. Henry in 1937* (CM); VENANGO COUNTY, 1 mi. N of Perry Run along Allegheny R., *A. J. Deer in 1933* (CM); WARREN COUNTY, North Warren, *H. N. Moldenke 15427* (CM, ND, OLKA, OSC, VDB); WAYNE COUNTY, 1.5 mi. NE of Cold Spring, *H. A. Wahl 14512* (NCU); WESTMORELAND COUNTY, 7 mi. N of Ligonier, *C. T. Agostini in 1933* (CM); WYOMING COUNTY, W of Dunkhannock, *J. Bright in 1925* (CM). RHODE ISLAND: PROVIDENCE COUNTY, Chapachet, Douglas Hook Road, *R. Champlin in 1973* (NEBC). SOUTH DAKOTA: CUSTER COUNTY, Custer, *P. A. Rydberg 712* (GH, NMC, NY, US), Sylvan Lake, *J. M. Moore 33* (MIN), ravine at SE base of Buckhorn Mt., *A. C. McIntosh 557* (RM, SDU); LAWRENCE COUNTY, 7.5 mi. S of Spearfish, *S. Stephens 7724* (DS, KANU), on road to Terry Peak, *T. Van Bruggen 5894* (SDU); MEADE COUNTY, Piedmont, *A. Pratt in 1895* (MIN, POM, WIS); PENNINGTON COUNTY, Sylvan Lake, *W. Over 15833* (US). TENNESSEE: BLOUNT COUNTY, Gregory Bald, Great Smoky Mountains National Park, *A. J. Sharp 1959* (TENN); CARTER COUNTY, summit of Roan Mt., *K. Rogers & J. K. Underwood 34663* (TENN); COCKE COUNTY, vicinity of Cosby, *J. R. Raper & H. M. Jennison 3263* (TENN); SEVIER COUNTY, Little Pigeon R. at Chimney Caps Trail, *S. A. Cain & A. J. Sharp 650* (MO). VERMONT: ADDISON COUNTY, Middlebury, *C. Knowlton in 1933* (NEBC); BENNINGTON COUNTY, South Shaftsbury on U.S. rte 7, *H. E. Ahles 67929* (DS, MASS, NEB, WVA); CALEDONIA COUNTY, Lyndonville, *D. S. Conant & A. Kitfield 2917* (BM, G, K, KYO, LD, MHA, MO, NY, P, S, SHIN, UC); CHITTENDEN COUNTY, Williston, *S. F. Blake 2552* (LL, US); ESSEX COUNTY, Canaan, rte 114, *F. C. Seymour 25674* (CAS, MO, SMU); FRANKLIN COUNTY, Franklin, *R. Woodward in 1912* (NEBC); LAMOILLE COUNTY, Stowe, Mt. Mansfield, *J. Murdoch, Jr. 1695* (NEBC); ORANGE COUNTY, Brookfield, *F. C. Seymour 22176* (MO); ORLEANS COUNTY, Morgan, Seymour Lake region, *J. Harper 33* (PH); RUTLAND COUNTY, 2.9 mi. E of junction Vt. rte 140 & U.S. rte 7 on rte 140, *H. E. Ahles 68917* (DS, GA, NDA, PAC, US); WASHINGTON COUNTY, Worcester, *W. Blanchard in 1875* (NEBC); WINDHAM COUNTY, Whitingham, *H. E. Ahles 68575* (NLU, UMO); WINDSOR COUNTY, 3.2 mi. S of junction Vt. rte 100 & U.S. rte 4 on rte 100, *H. E. Ahles 68128* (CM, DS, ISC). VIRGINIA: AMHERST COUNTY, Blue Ridge, Elk Pond Mt., *C. E. Stevens 2088* (LYN); AUGUSTA COUNTY, Little R. NW of Stokesville, *B. J. & A. M. Harvill 22163* (FARM); BATH COUNTY, Warm Springs Mt., near Hot Springs, *C. E. Stevens & L. Carr 7588* (FARM); BOTETOURT COUNTY, Appalachian Trail on W side of Rich Mt., *R. S. Freer 2155* (GH, LYN); FLOYD COUNTY, Buffalo Mt., *C. E. Stevens 13001* (FARM); GILES COUNTY, Cranberry bog near White Pine Lodge, *J. W. Hardin 2490* (NCSC, VDB); GRAYSON COUNTY, Saddle on Brier Ridge, *A. R. Shields in 1954* (VPI); GREENE COUNTY, N slope of Bush Mt., Shenandoah National Park, *T. F. Wieboldt 572* (WILLI); HIGHLAND COUNTY, Allegheny Mt., near Bear Mt., *C. E. Stevens & L. Carr 1333* (FARM); MADISON COUNTY, Shenandoah National Park, the Limberlost, *C. E. Stevens 10986* (FARM); NELSON COUNTY, Montebello, grounds of State Fish Hatchery, *R. S. Freer 1874* (GH, LYN); PAGE COUNTY, near Luray, *E. S. & Mrs. Steele 109* (MIN); ROCKBRIDGE COUNTY, Blue Ridge, Elk Pond Mt., *C. E. Stevens 11372* (FARM); ROCKINGHAM COUNTY, Virgin Forest above Skidmore Fork, *A. M. Harvill 20047* (FARM); SMYTH COUNTY, Mt. Rogers, near summit, *R. Kral 11647* (VPI); TAZEWELL COUNTY, Morris Knob, *C. E. Stevens & R. J. Watson 7381* (FARM); WASHINGTON COUNTY, summit of White Top Mt., *J. K. Small in 1892* (MASS). WASHINGTON: FERRY COUNTY, Sherman Creek, 15 mi. W of Kettle Falls, *L. Boner & V. Weldert 238* (DS, UC, UTC, WS); Colville National Forest, just S of Trout Lake, *S. Saufferer 275* (NY); Gray's Harbor County, Road to Olympic National Park S of Lake Quinault, *Cooke et al. W2324* (ASU), Montesano, *J. M. Grant 832* (WS), Lake Quinault, *W. Bailey 2* (WS); JEFFERSON COUNTY, Olympic Peninsula, Quinault R., *Leach & Leach in 1929* (ORE), ca. 18 mi. NE of Quinault via Park Road, *V. J. Wetherell 547* (RM), Quinault Valley, 0.25 mi. above lake, *H. S. Conrad 133* (MIN, NEB, NY, PENN, PH, US, WS, WTU), Olympic Peninsula, upper Hoh R., *W. C. Muenscher & B. I. Brown 23242* (CU), Olympic National Forest near Jackson Guard Station, Hoh R., *J. E. Schwartz 11A* (WTU); KING COUNTY, Seattle, *E. A. Shumway in 1892* (WTU), Kings Lake, 1 mi. W of Boyle Lake, NE of Snoqualmie Falls, *G. Ledbednik 383* (WTU), Snoqualmie Falls, *C. Piper 3804* (GH, NY, US, WS); KITTITAS COUNTY, valley of Swauk R., *S. Sharples 156* (GH); SKAGIT COUNTY, near Prairie P.O., *H. R. Talcott in 1891* (MICH), Bear Creek near Concrete, *L. R. Mason in 1932* (UC); SNOHOMISH COUNTY, Cascade Mts., Big Four Inn, *J. W. Thompson 14701* (ALTA, CAN, CAS, GH, MO, NA, NY, PH, RSA, UC, US, W, WS), Snoqualmie National Forest, *E. A. Purer 7718* (DS, WIS), Index, *T. E. Savage et al. in 1898* (COLO, IA, MO, PH, WS); SPOKANE COUNTY, Rock Creek near Mica Peak, *W. N. Suksdorf in 1889* (WS); WHATCOM COUNTY, Baker to Mt. Baker, *W. Bailey in 1908* (WTU), ca. 3 mi. NW of Baker Lake, *G. W. Douglas 1431* (DAO), Mt. Baker National Forest, Baker Hot Spring, *W. C. Muenscher 8266* (CU, GH, WS), Swift Creek, *W. C. & M. W. Muenscher 5981a* (CU), Fairhaven, *W. N. Suksdorf in 1890* (WS). WEST VIRGINIA: FAYETTE COUNTY, Babcock

State Park, *W. N. Grafton & C. McCraw in 1973* (WVA); GRANT COUNTY, 1 mi. S of Bismark, *C. L. Clarke 291* (WVA); HARDY COUNTY, Trout Run where trail leaves Wardensville Hwy for Sugar Knob Shelter, *H. A. Allard 6808* (WVA); MONONGALIA COUNTY, Cheat, Morgantown, *B. D. Barclay in 1925* (WVA); PENDLETON COUNTY, Spruce Knob, *A. J. Sharp 138* (KSC, MO, NA, NCSC, NY, OSC, PENN, SMU, UC, VPI, WVA); POCAHONTAS COUNTY, Cranberry, *G. Guttenberg in 1877* (CM); PRESTON COUNTY, Terra Alta, *B. Quantz in 1937* (WVA); RALEIGH COUNTY, Glade Creek, ca. 2 mi. above the bridge where rte 3 crosses, *J. P. Tosh 834* (US, WVA); RANDOLPH COUNTY, on top of Cheat Mt., *R. B. & J. Clarkson 599* (MAK); SUMMERS COUNTY, Keeney Knob, *West Virginia Univ. Bot. Exped. in 1928* (WVA, WVW); TUCKER COUNTY, Canaan Valley, on top of Bald Knob, *H. A. Allard 19683* (US); UPSHUR COUNTY, Canaan Valley, *J. S. Netting in 1933* (CM); WEBSTER COUNTY, Camp Caesar, *West Virginia Univ. Bot. Exped. in 1929* (DS, GH). WISCONSIN: ADAMS COUNTY, Big Flats Township, *T. Hartley 5639* (WIS); ASHLAND COUNTY, Apostle Island National Seashore, Basswood Island, *R. G. Koch 8660* (MASS, NLU, UT); BARRON COUNTY, Barron, *C. Goessl 8719* (B, WIS); BAYFIELD COUNTY, ca. 9 mi. N, 2 mi. W of Bayfield, Little Sound Bay, *R. G. Koch 8638* (MASS, UT, WIS); BROWN COUNTY, Scott, *J. Schuette in 1897* (NY); CALUMET COUNTY, *W. A. Kellerman s.n.* (OS); CLARK COUNTY, 5 mi. SE of Worden Township, *M. Bergseng in 1948* (WIS); COLUMBIA COUNTY, near Lost Lake, E end of Baraboo Hills, *N. C. Fassett 22331* (WIS); DANE COUNTY, Madison, *L. Cheney s.n.* (WIS); DOOR COUNTY, Washington Island, *A. Fuller 1433* (WIS); DOUGLAS COUNTY, ca. 1 mi. N of Solon Springs, *R. G. Koch 5797* (MASS, UT); DUNN COUNTY, Menomonie, *C. Goessl 9029* (B); FLORENCE COUNTY, 6 mi. ENE of Long Lake, *H. H. Iltis et al. 20421* (OSC, WIS); FON DU LAC COUNTY, Kettle Morain Forest, Marthe L., *H. H. Iltis & W. Buckman 10770* (WIS); FOREST COUNTY, Argonne Experimental Forest, *G. W. Thomson 46* (ISC); GRANT COUNTY, T6, R1W, Sec. 11, NE $\frac{1}{4}$ , *T. S. Cochran 5567* (WIS); IOWA COUNTY, ca. 2 mi. S of Mineral Point, *S. C. Wadmond in 1935* (MIN); IRON COUNTY, ca. 8 mi. S of Hurley, *R. G. Koch 9695* (NLU); JACKSON COUNTY, 6 mi. NE of B. N. Falls, *D. Grether 6325* (WIS); JUNEAU COUNTY, Lyndon Township, *T. Hartley 4214* (WIS); KEWAUNEE COUNTY, near Algoma, *E. J. Palmer 28819* (MO, UMO); LACROSSE COUNTY, Washington Township, *T. Hartley 734* (IA, WIS); LINCOLN COUNTY, Harrison Township, *Wild Flower Club in 1955* (WIS); MANITOWAC COUNTY, Cooperstown, Maribel Caves, *N. C. Fassett 18522* (UBC, WIS, WS); MARATHON COUNTY, near Granite Heights, *L. Cheney 3030* (WIS); MARINETTE COUNTY, near Peshtigo, *C. O. Grassl in 1936* (MICH); MARQUETTE COUNTY, bluff above Lawrence Creek, *P. D. Sorenson 1605* (IA); MENOMINEE COUNTY, Valley of the Giants, *G. Goff in 1964* (NCU); MILWAUKEE COUNTY, N Greenfield, *R. M. Strong in 1892* (KSC); OCONTO COUNTY, T32N, R15E, Sec. 35, *R. & D. Schlising 1032* (WIS); ONEIDA COUNTY, American Legion State Forest, Clear Lake, *P. B. Whitford 1893* (IA); OUTAGAMIE COUNTY, Grand Chute, *F. C. Seymour 10250* (KANU); OZAUKEE COUNTY, N side of small Lake, S of Newburg, *W. W. Oppel et al. 604* (UC, WIS); PEPIN COUNTY, E of Durand, Chippewa R. valley, *C. O. Rosendahl & F. K. Butters 3113* (MIN); POLK COUNTY, St. Croix Falls, *C. F. Baker in 1900* (DS, POM); PRICE COUNTY, 4.5 mi. E of Ogema along Wisc. 86, *H. H. Iltis & W. Buckman 11686* (GA, WIS); RACINE COUNTY, 1 mi. NE of Ives, *S. C. Wadmond 3228* (MIN); RICHLAND COUNTY, 4 mi. NE of Ithaca, *M. Nee in 1974* (WIS); ROCK COUNTY, Beloit, Rock R. Valley, *G. Swezey s.n.* (WIS); RUSK COUNTY, T34N, R8W, Sec. 19, *R. Anderson in 1962* (WIS); ST. CROIX COUNTY, Apple R. Canyon 2 mi. upstream from St. Croix R. junction, *N. Russell in 1948* (MIN); SAUK COUNTY, Parfrey's Glen, Merrimac, *W. V. Grotjan 103* (TENN); SAWYER COUNTY, Pickerel Lake (Lake of the Pines), *H. H. Iltis 20612* (WIS); SHAWANO COUNTY, 1 mi. N of Loon Lake, *J. Gunderson 230* (WIS); SHEBOYGAN COUNTY, Sheboygan, Andrae State Park, *A. Fuller 220* (WIS); TAYLOR COUNTY, 1.5 mi. NW of Rib Lake, *O. Anderson 195* (OKLA, WIS); VERNON COUNTY, Wildcat Mt. State Park, *T. & R. Hartley 1800* (IA, US, WIS); VILAS COUNTY, W of Plum Lake, *J. Marr 221* (MIN); WASHBURN COUNTY, Audubon Camp of Wisconsin, *H. Irwin in 1966* (WIS); WAUSHARA COUNTY, slope above Marl Lake, *P. Sorenson 2219* (IA, WIS); WINNEBAGO COUNTY, Oshkosh, *W. Kellerman s.n.* (US, WIS); WOOD COUNTY, Pittsville, *C. Colby 4510* (CAS). WYOMING: ALBANY COUNTY, Hermosa (SSE of Laramie), *J. F. Macbride 2608* (MO, RM); TETON COUNTY, Grand Teton National Park, along Bradley Creek, *L. Williams 854* (CAS, MO, NA, NY, RM, UTC).

## EUROPE

AUSTRIA. Tirol, Karlsteg, above Mayrhoften, *J. Ball in 1871* (PH); near Plecknerhaus, *J. Ball in 1875* (CAS); Wien, *I. Dorfler s.n.* (ND); Kärnten, Annenheim, *G. Cufodontis in 1970* (W); Siebenburgen, Fogarascher Mts., Bulea-Tal, *A. Ginzberger in 1910* (WU); Kärnten Hohe Tauern, *Girtf in 1924* (W); Kärnten, Karawanken, *Girtf in 1930* (W); Vorarlberg, Bregenzerwald, E of Damuls, *H. J. v. Hattum & S. J. v. Ooststroom in 1952* (MT); Kärnten, Gailtal, *F. Höpflinger in 1949* (NDA); Tirol, Trins, Gschnitz valley, *A. Kerner, Fl. Exs. Aust.-Hung. 1272* (L, MIN, US, W); Tirol, Gerlostal, near entrance of Krummbachtal, *K. Kramer 1404* (SMU); Salzburg, Upper Pinzgan, *K. Konniger in 1936* (W); Kärnten, Klagenfurt, *Krenberger s.n.* (UC); Tirol, Kitzbühler Alps, new Bamberger Hut

to Wegscheid Guesthouse, *F. Krendl in 1969* (W); E Alps, Steiermark, SW of Kammern, *W. Möschl & H. Pittoni 71* (COLO); Salzburg, St. Johann in Pongari, *S. Müllner in 1876* (W); N Tirol, Lechtaler Alps, from Madau to Memminger Hut, *A. Polatschek in 1972* (W); Oberintal, between Schonwies & Imsterberg, *A. Polatschek in 1972* (W); Staubaier Alps, Axams, *A. Polatschek in 1975* (W); E Tirol, between Mittewald & Thal, *A. Polatschek in 1976* (W); Steiermark, Schwanberg, *E. Preissmann in 1864* (W); Kärnten, Gselsberge near Winklern, *E. Preissmann in 1880* (W); Steiermark, Grobming, *E. Preissmann in 1897* (W); N Tirol, Staubaier Alps, Neustift, Obernbergtal near Bärenbad, *M. Pull in 1971* (W); Tirol, Huben, Lienz, *J. Schneider in 1925* (W); Gailthaler Alps, Kärnten, *Tanthen in 1903* (W); Salzburg, Leogang, *J. Vetter in 1911* (W); Muhlviertel, Stratberg, *J. Wurm-Zochbauer in 1968* (W).

CZECHOSLOVAKIA—POLAND. Tatra Mts., Matadaka, *B. Kotula in 1845* (W).

DENMARK. Själland, Bögeskoven, *F. Bergesen in 1889* (MO); Själland, Valsøllile Sö, *C. Jensen in 1877* (MO); Själland, Stokkebjerg woods near Skarridso Lake, 20 mi. E of Kalundborg, *T. Leth in 1864* (DS); Jutland, SE of Vilborg, Hjermed, *T. Leth in 1873* (DS); Falster Island, *Rasmussen s.n.* (W); Silkeborg, Nesterskov, *M. ? in 1893* (W).

FINLAND. Alastaro, Kärkkäänjoki, *K. Alho in 1966* (TUR); Korpoo, Ävensör, *K. Alho & U. Laine in 1967* (TUR); Sortavala, *P. Brofeldt in 1909* (TUR); shore of Kaukjärvi Lake, opposite Talpola, *S. Cantell in 1936* (DAO); Tuktig, Salo, *G. Ekinan in 1902* (TUR); Eh, Mänttä, Mänttävuo, *P. Eloranta in 1963* (TUR); near Turku, Vihti, *A. Heikel in 1902* (TUR); Inari, Uutela, *K. Karinkanta in 1960* (DAO, TUR); Eurajoki, Kuivalahti, *I. Kause in 1963* (TUR); Rauma, Nurmisaari, *I. Kause in 1965* (TUR); Eura, Kauttua, *I. Kause & E. Seikkula in 1966* (TUR); Karhumäki, N Kumsajoki, *O. Koskinen in 1943* (TUR); Paltamo, Melalahti, *O. Kyyhkynan in 1920* (TUR); Puolanka, Salminen, *O. Kyyhkynan in 1920* (TUR); Aland, Brändö, S Lappo Island, *U. Laine & J. Virtanen in 1968* (MAK, TUR, UC, W); Aland, Kökar, Karlybylandet Island, *U. Laine & J. Virtanen in 1972* (TUR); Kuusamo, Salla, near Kutsajoki R., *M. Laurilo in 1939* (H); Kuopio, *M. Lehtovuori in 1959* (TUR); Aland, Eckerö, *H. Lindberg in 1892* (W); Salmijärvi, *K. Linkola in 1925* (H); Kittilä, *K. Linkola in 1925* (H); Tavastia, Sääksmäki, Ritvala, Oitti, *K. Linkola in 1932* (NCU); Kuusamo, Juuma, *N. Lounmaa in 1949* (H); Kuusamo, Paanajärvi, *H. Luther in 1933* (H); Ostrobotnia, Sotkamo, Jormasjärvi, *K. Metsävainio in 1937* (DAO, MT); Nauvo, Kasaholm, *J. Nurmi in 1963* (TUR); Etelä-Häme, Korpi-lahti, Rutalahti, *M. Ohenoja in 1972* (TUR); Nütty, Wüपुरi, Latukkanismi, *M. Ollila in 1929* (RSA); Lammi, Untula, *J. Puro in 1955* (TUR); Säkylä, Nummioja, *H. Sältin in 1952* (TUR); S Tavasti, Kangasala, *V. Seppälä 822* (MO, UC, W); Volkeala, *O. Sikkilä in 1943* (TUR); Inari Lapnad, E shore of Lake Puolbmak, *P. Siltanen in 1964* (TUR); Kiikka, Nevo, *J. Suominen in 1960* (TUR); Punkalaidun, Kivisenoja, *J. Suominen 2407* (TUR); Tyrvää, Humaloja, *J. Suominen in 1960* (TUR); Kuusamo, Oulanka, *J. Tammisola in 1960* (TUR); Rantasalmi, Vaahersalo, *M. & P. Tsouïita in 1958* (TUR); Pohjois-Pohjanmaa, Pudasjärvi, *T. Ulvinen in 1973* (H, PH); Kuusamo, Juuma, *P. Vuori in 1958* (TUR); Porvoo, Sundö, *V. Wahlbeck in 1903* (TUR); Saarijärvi, *H. Waris in 1906* (TUR).

FRANCE. Dauphine Alps, *E. Ayasse in 1864* (UC); Isere, Grande-Chartreuse, *R. Barbezat 1323* (DAO, K, WTU); Puy-de-Dome, Mt. Dore, *P. Billiet in 1883* (LD); Haute-Pyrenees, Gavarnie, *Bordere s.n.* (G); Mende, *M. Brown s.n.* (G); Vosges, Autry, Chilimont Valley, *C. Claire 493* (DS); Haute-Savoie, forests of Goleze, *G. Delavay in 1861* (MO); Hautes-Pyrenees, Col of Bareges, *P. Estivol 9058* (G, MA, W); Hautes-Pyrenees, Cauterets, valley of Lutour, *J. Fiton 2724* (B, CAS, MT); Puy-de-Dome, Capucin, Mt. Dore, *A. Gautier in 1848* (W); Mijanes, *G. Gautier in 1894* (DS); St. Martin-Vesubie, *G. Gavelle in 1962* (MA); Vosges, Liezy, *J.-F. Jacquelin in 1864* (DS); Haute-Pyrenees, Val de Gerret, between Raillere and Pont-d'Espagne, *P. Jarris 2878* (DS, MT); Savoie, forests of Belleville, Hauteluce, *E. Perrier in 1858* (UC); Vosges, Rochesson, Gerbamont, *D. Pierrat in 1869* (DAO, DS, MT); Vosges, Gerbamont, *C. Pierrey in 1865* (W); Bagnères-de-Luchon, *E. Peyron in 1892* (G); Vosges, Alsace, *B. de Retz 3439* (CAS); Hautes-Pyrenees, Cauterets, *F. Saltel in 1886* (MA); Cantal, Cirque of Falgoux, *N. Sandwith in 1950* (K); Bitche & Deux-Ponts, *F. Schultz 32* (MO, W); Isere, St.-Mary-de-Monteymond, *M. Verlot 2878* (CAS, DS, MT); Hornschloss near Reims, *M. Veth 38* (W); Grande-Chartreuse, chemin du Sapply, *E. A. Willmott in 1860* (DAO); Boujailles, *E. A. Willmott in 1886* (DAO).

GERMANY, EAST. Thuringen, Gehlberg, *J. Bornmüller in 1912* (B); Thuringen, Masserberg, *J. Bornmüller in 1921* (B); Niesky in Lausitz, *A. Burkhardt 777* (W); Harz, Regenstein, *G. DeChalmot s.n.* (US); Neumark, Griesel, *Goleus in 1974* (B); Mecklenburg, Lubbersdorf, *K. Hahn in 1907* (B); Mark, Lythen, *Heiland in 1887* (B); Königsberg, *C. Ralintz in 1870* (PENN); Kreuzberg, *G. Schub in 1871* (DS); Elbingerode, Hohne, *R. Schube in 1913* (B); Thuringen, Leutenberg, *Wrefil in 1897* (WA).

GERMANY, WEST. Hannover, Laupark, *C. Borner in 1898* (RO); Augsburg, *Caplisch s.n.* (B); Oberbayern, near Oberaudorf, vicinity of Trisslbades, *G. Eigner & Vollman in 1902* (UC); Bayern,

Allgäuer Alps, near Obnofsdorf, *Girtf in 1916* (W); Holstein, Luebeck, *Girtf in 1931* (W); near Eschenau, *H. Glück in 1898* (UC); Bayern, Nürnberg, *H. Glück in 1899* (MO); between Harzburg & Thorsshaus, *Heiland in 1889* (B); near Allenstein, *L. Huffen in 1936* (DAO); Oberhessen, Alsfeld, Erbenhausen, Siebenstruth, *H. Hupke in 1972* (USAS); Allgau, Freiberg, *Kuhn in 1870* (NEB); Westwald, Lower Dreselndorf, *A. Ludwig & H. Andres 178* (W); Königsberg, Vierbrüderkrug, *C. Ralintz in 1872* (W); Bayern, Kaiserslautern, Palatin, *F. Schultz s.n.* (POM); Moelschbach & Kaiserslautern, *F. Schultz 852* (W); Hamburg, *Steetz s.n.* (PH); near Ortelsburg, *H. Steffen in 1936* (DAO); Ramsbeck, Westphalen, *J. H. Wibbe in 1863* (DAO); Bayern, Schwarzwald, Feldberg, *without collector in 1834* (NY).

HUNGARY. Szepes, Iglöfüred, *F. Filarszky, Fl. Hung. Exs. 60* (B, L, MO, MT, RO, TUR, UC, US, W, WU); Lglo (Igló?), *Dietz in 1878* (ISC).

ITALY. Bologna, *Effaolite in 1900* (NEB); Pedemontium, Torino, Ceresole Reale, *E. Ferrari et al. 1882* (K, NEB, RO); Sappada, *Pemeri in 1934* (LD); Rio delle Finocchielle, Monte Acuto, *G. Pizzini in 1884* (RO); Appennina Modenese, near Fiumalbo, *P. Riva in 1889* (RO); Cottian Alps, Torino, *E. Rostan in 1880* (L); Forno di Zoldo, *St. Lager in 1895* (G); Bellano, Rocca di Pietore, *St. Lager in 1895* (G); Bergamo, Seriana valley, *St. Lager in 1906* (G); Appenino Lucano, near Lake Baccio, *S. Sommier in 1881* (RO).

NORWAY. Fjordane, near Fortun, ca. 5 km E of Skjoden, *C. C. Berg 70-1973* (NCU); Sør-Trøndelag, Saelbu, *F. E. Conradi in 1886* (DAO); Sogn og Fjordare, valley above Esen, near Balstrand, *R. B. Drummond 4815* (NO); Vestfold, Sande hd., Kommersøen, *J. Dyring in 1916* (COLO); Fjordane, Sogndal hd., Sogndal, *K. Faegri in 1929* (MT); Sørskjomen, head of Skjomen Fjord, *F. Fosberg 32989* (US); Viblungsnas, Romsdalen, *C. A. Gad in 1886* (WS); Polmak, Finmark, *P. Kallio in 1965* (TUR); Troms, Lyngen, *I. Kause in 1959* (TUR); Modum, *J. Lange in 1880* (MIN); Gudbrandsdalen, Ringsben, *P. Söderlund in 1904* (DAO); Ruostavand, Tromsø, *E. Taylor in 1907* (GH); Fjordane, Breim, Gravarvatnet, Egge, *O. Vasshaug in 1962* (COLO).

POLAND. Beskid Zywiecki, Rezerwat Romanka, *K. Bialecka in 1965* (KRA); Brenna, Beskid Slaski, *M. Broda in 1967* (KRA); Grodziszczce Dist., Swieciany, *I. Dabkowska in 1937* (US); Wladyslawowski, *K. Drymmer in 1885* (WA); Turecki, *K. Drymmer in 1889* (WA); Wegrowski, *K. Drymmer in 1893* (WA); Gostynski, *K. Drymmer in 1895* (WA); Suprasl, *A. Ejsmonda in 1886* (WA); Rypinski, *A. Gmoud in 1885* (WA); Bystrzyca Kłodzka, Spalona, Slask Dolmy, *S. Gołowin, Fl. Silesia Exs. 160* (DAO, TUR, W, WA); Lukowski, *Kazimierz in 1874* (WA); Warszawa, *Kazimierz in 1877* (WA); Kielce Dist., Bukowa gora near Klonow, *K. Kaznowski in 1926* (POM); Białowieza National Park, part of the Puszcza Biolowieska, primeval forest on the Russian border, *P. Ketner 350* (KYO, SHIN); Pieniny Mts., Nowy Targ Dist., Kroscienko, *I. Kucowa 239* (COLO, KRA, KYO, MO, NCU, PH, UBC, UC, WA, WTU); Majdan, *F. Kwiecinski 788* (WA); Sudetic Mts., Sudetica, Winkelsdork, *F. Lanüek in 1925* (MSTR); Tuchow, *Z. Lapczynski in 1874* (WA); Tetry Mts., *Z. Lapczynski in 1880* (WA); Pomorze Zach, Chojnice, *S. Lisowski et al. in 1968* (KRA); W Carpathians, Tatri, Bobrowiec nad Polana Chocholowska, *J. Madalski et al., Pl. Pol. Exs. 351* (DS, KRA, KYO, L, MO, MT, US, WA); Pieniny Mts., Nowy Targ Dist., *H. Piekos in 1970* (SMU); Kotlina Sandomierska, Wola Zarczycka, *Z. Raciborski 672* (KRA, WA); Kotlina Sandomierska, Wola Zarczycka, Lezajskiem, *M. R. Rosling Polskie in 1909* (KYO); Gory Swietkrzyskie, *Schuabel s.n.* (WA); E Prussia, Kreis Goldap, Borvalker Forest, *R. Schultz 344* (CAS); Dobrznska, *H. Talewski in 1890* (WA); Wadowice Dist., Lanckorona, *J. Trela, Pl. Pol. Exs. 351* (DS, KRA, KYO, L, MO, MT, WA); E Schlesien, *J. Vetter in 1908* (W).

ROMANIA. Balcani Comm., Frumoasa, *N. Barabas, Fl. Exs. Bacov. 428* (TUR); Bucovina, Piatra Liboa, *D. Herbich s.n.* (W); Sinaia, *Loitlesberger in 1897* (W, WU); Moldavia, near Cirlibaba, *D. Mititelu et al. 252* (WA); Transsilvania, Odorhei Dist., above Corund, *E. Nyarady, Fl. Rom. Exs. 1297* (MO, RO, US, W, WA).

SPAIN. Navarra, Roncesvalles, *L. Nee in 1786* (MA); Pirineo, entrance to Caldes de Bohi & Estang de Cavallers, *without collector in 1944* (MA).

SWEDEN. Södermanland, Musko socken, Gullboda, *E. Asplund in 1924* (MO); Närke, Hidinge, *E. Asplund in 1925* (UC); Södermanland, Grödinge, Tegelvreten, *E. Asplund in 1930* (CAS, MO, RM); Östergötland, Gryt, Vaggön, *E. Asplund in 1945* (RO); Södermanland, Paroecia, Sorunda, Villkulla, *E. Asplund, Pl. Suec. Exs. 1223* (COLO, DAO, MT, MTJB, NCU, RSA, W); Dalarne, Norrbärke, Dagkarlsboberget, *R. Bergland in 1964* (SMU, TUR); Ängerwauland, N of Fjardbotten Skog, *E. Evers in 1964* (MAK); Västmanland, Fagersta, *E. Folkesson in 1940* (MO); Ängermanland, Österåsens Sanatorium, *H. Fries in 1903* (MT); Värmland, Råda, *H. A. Froding in 1895* (MT); Småland, Ljongarum, Sanna, *Fr. Hagstrom in 1890* (DAO); Skåne, Ivetofta, Bromölla, *C. Hammarlund in 1958* (COLO); Västergötland, Östad, Ramdalen, *T. E. Hasselrot in 1952* (RO); Madelpad, Singo,

*G. Hjort* in 1906 (W); Östergötland, Omberg, *K. Holm* in 1924 (WTU); Madelpad, Timrå, *K. Holm* in 1953 (SMU); Vermelandia, Vidan, *A. Hulphers* in 1899 (MIN); Avesta, Dalecarli, *C. Indebetou* in 1889 (MA); Halleburg, *K. Kahne* in 1910 (MIN); Närke, Hallsberg, Skäleklint, *G. Kjellmert* in 1942 (UC); Skåne, Stenestad, *H. Lanander* in 1903 (MO); Helsingland, Färila Parish, Skyte, *G. Lidman* in 1933 (RM); Östergötland, Omberg, *C. O. U. Montelin* in 1878 (ISC); Gunnebo, *H. Ohlemann* in 1890 (MA); Uppland, Ljusterö Parish, Östra Lagnö, *C. Ringenson* in 1918 (W); Uppland, Ljusterö, Östra Lagnö, *C. Ringenson* in 1923 (WS); Västergötland, Borås, Almenäs, *C. Sandberg* in 1938 (MT); Ångermanland, Överlänäs, *G. Söderholm* in 1909 (SMU); Västergötland, Ugglum, *S. Vallquist* in 1911 (DAO); Värmland, *B. Weiner* in 1888 (MTJB); Skåne, Angelholm, *E. Wieslander* in 1970 (VDB).

SWITZERLAND. Graubunden, Prätigau, *H. Berger* in 1913 (B); Lucomagno Mt., Medels & St. Maria Valleys, *R. & A. Keller* in 1900 (Z); Tarasp, *Killias* in 1870 (Z); Prätigau, Arosa, *J. Macfarlane* in 1906 (MO, PENN, US); Vaud, Bex, *Schleicher s.n.* (UC).

UNITED KINGDOM: ENGLAND. Westmorland, Knock Fell, Moor House Reserve, *A. Eddy* in 1961 (DS); Westmorland, Knock Ore Gill Head, *A. Proctor* in 1964 (DS); Westmorland, Glencoyne Woods, Ullswater, *P. Raven* 16222 (DS). SCOTLAND. Arran Island, Brodick, *Lenox?* in 1885 (DS); Easterness, Suidhe, Kincaig, *M. McCallum-Webster* 16625 (MO). WALES. Merioneth, Penant Dyfi, *P. H. Raven & W. Condry* 16294 (DS).

YUGOSLAVIA. Croatia, Plitvice, *A. Ginzberger* in 1909 (WU).

#### U.S.S.R.

AZERBAIJAN S.S.R. Caucasus Mts., Balkovia, Agaschtan, *E. & N. Busch* in 1925 (S); Caucasus Mts., Kuba Dist., between Leze & Mt. Kyzyl-kaja, *I. Karjagin* in 1935 (NY, UC). BELORUSSIAN S.S.R. Mogilev Prov., between Mogilev & Borysthenen, *N. Downer* 1862 (MW); Minsk Prov., Iqumensk Dist., Zhornovska, 4 km W of Lopiczi, *O. Polianskaja* in 1924 (MW); Veliki Berezny, Lyuta, *A. K. Skvortsov* in 1968 (MO); Brest, *A. K. Skvortsov* in 1974 (MO). ESTONIAN S.S.R. Wesenberg, Vezo, *S. S. Ganeskin* in 1913 (MW); Parnumaa, Voltveti, *O. Kyyhkynen & K. Linkola* in 1924 (TUR); Tartto, Vasula, *O. Kyyhkynen & K. Linkola* in 1924 (TUR); Krestovskiy Island, *D. E. Regel* in 1866 (L, MIN, NDG, W). GEORGIAN S.S.R. Osetiya, between Tkue & Kosekha, *A. H. & V. F. Brotherus* 343a (BM), 342 (BM, H; *C. × intermedia* and *C. lutetiana* subsp. *lutetiana* also part of this collection); Mt. Kazbek, *A. H. & V. F. Brotherus* 343 (H); Caucasus Mts., Ratcha Mts., *A. K. Skvortsov* in 1976 (MO). KAZAKH S.S.R. Ust-Kamenogorsk Prov., Bolschenarimskoje Dist., Narimski, *V. N. Voroshilov* 4183 (MHA). LATVIAN S.S.R. Curonia (Kurland), Papenhof & Kalnischke, *P. Lakschewitz* 9669 (MO); at the Dvina R., near Koknese, *P. Lakschewitz* 7498 (MO). LITHUANIAN S.S.R. Kaunas, *B. Hryniewiecki* in 1899 (WA); Kupishkis, *A. Kranckiewicz* in 1939 (WA); Shamajski, Shilueny, *P. Maziljascaite* in 1958 (MW); Vilnius, *J. Schnell s.n.* (WA); Minojty, Lida Dist., *T. Symonowiczowna* 434 (KRA, W, WA, WU). MOLDAVIAN S.S.R. Suceava Dist., *D. Mitetelu et al.*, *Fl. Moldavia Exs.* 252 (TUR). RUSSIAN S.F.S.R. Khabarovsk Prov., at the Taykan R., *M. A. Akhmet'ev* in 1961 (MHA); Leningrad Prov. Kingisepp Dist., Narovski, Kurgolovski, *A. G. Borisova* 698 (MW); Sachalin, near Kussunai, *Brylkin* in 1860 (K, UPS); Pskov Prov., Velikolutzski Dist., Vladykino, *A. Bulevkina & N. Ikonnikov-Galitzky* in 1921 (MW); Kuban Prov., Teberda R. valley, mouth of Amananda R., *N. A. Busch* in 1896 (NY, W); Caucasus Mts., Kuban Prov., *E. Busch* in 1909 (DS); Novesiverskaya, vicinity of Leningrad, *Chermjakoskya* 73 (DAO); Amur Prov., divide between Nora & Mamyra Rivers, *V. S. Dokturovsky* 1326 (S); Sachalin, Moneron (Kaibato) Island, *E. Egorova* 2557 (MHA); Sachalin, Makharov Dist., Gornaya, *E. Egorova & L. Koltshanova* 2879 (MHA); Sachalin, Smirnykh, *E. Egorova & A. Tschernyayeva* 3639 (MHA); Kamtschatka, vicinity of Eligovo, *E. Egorova & V. Voroshilov* 9776 (MHA); Kurbulik, middle part of Lake Baikal, *S. J. Enander* in 1913 (S); Transbaical, Kyrmyko, *S. J. Enander* in 1913 (S); Kamtschatka, Savoiko, *W. Eyerdam* in 1928 (GH, MICH, MO, NY, US); Sachalin, Takinosawa, *U. Faurie s.n.* (KYO); Sachalin forests of Vladimirov, *U. Faurie* 423 (BM, KYO, P); Viatke Prov., Bassein, Malmyzh, *A. Fokin* 142 (MW); Leningrad Prov., Shlieselburg Dist., Neva R., Peski, *S. S. Ganeshin* in 1915 (MW); Moscow Prov., Losinojostrow, *W. Grigoryev* 515 (G, W, WA, WU); Irkutsk Dist., near Kukunut, *M. A. Hilova* 164 (H); Sachalin, Mt. Tosso, *N. Hiratsuka* in 1927 (SAP, TI); Sachalin, Yuzhnosakhalinsk ("Toyohara"), *M. Honda & Y. Kimura* in 1940 (TI); Kamtschatka, S shore of Avacha Bay, Bogatyrjovka, *E. Hulten* 456 (S), *E. Hulten* 472 (CM, S); Kamtschatka, Golygina village, *E. Hulten* 2745 (S); Middle Ural, Michaelovski tract, *K. I. Igorshina* in 1939 (MW); Tverj Prov., 3 km W of Pavlovskaja, *A. Iljinskin* in 1927 (MW); Zejskaja Pristan at the Zea R., *F. Karo* 283 (BM, E, P); Khabarovsk Prov., Mamyn, *Karpenko* 21 (MHA); Novgorod Prov., near Novgorod, *A. Khokhryakov* in 1966 (MO); Yakutiya Dist., Aldan, Ajkokit, *A. Khokhryakov & M. Mazurenko* in 1968 (MHA); Novgorod Prov., Borovicz Dist., Msta R. valley, *V. Komarov* in 1915 (MW); Sachalin, Moneron ("Kaibato") Island, *S. Komatsu* in 1915 (TI); Leningrad, banks of Neva R., *F. Kornicke* in 1857 (S); Kasan, Yadrin, *S. Korzchinsky* in 1884 (ISC); Kasan Prov., Zarewokokschaik Dist., between Negodajevo & Abasnur, *S. Korzchin-*

sky in 1885 (MW); Krasnojarsk Prov., Chakarija Dist., Jaschtip, Abaza, *E. Kravtsova* 77 (MHA); Tobolsk Prov. & Dist., *P. N. Krylov & D. Sergievskaya* in 1927 (NY); Tobolsk Prov., Tobolsk, *P. N. Krylov & D. Sier s.n.* (NY); Baschkin Prov., Birsik, *S. E. Kucherovskaja* 843 (MW); Khabarovsk, Bolon-Odshalense, Amur, *I. W. Kusnezow* 382 (DS); Leningrad Prov., Luga Dist., Staritza R., *N. Lavitch* 94 (S); S Kamtchatka, Nikolajevsk, Podpruginski, *R. Malaise* in 1928 (S); S Kamtchatka, Lake Assabatche, *R. Malaise* 490 (S); central Kamtchatka, Shtchapina, *R. Malaise* 3477b (GH, S); Makarov Dist., vicinity of Zaozernoje, *E. Mikhalchenkova* 1198 (MHA); Lipecky, near Voranova, *T. Mojevikina* in 1967 (DAO); Vladimir Prov., Melenkovski, between Adina & Sykova, *M. I. Nasarow* 1653 (MW); Khabarovsk Prov., Sovetskaya Dist., Gavan, Tulutchi, *A. Nechayer* 159 (MHA); Smolensk Prov., Dorogobuzhski, Batischevo, Engelhardt Expt. Sta., *O. Neumark* 53 (MO, MW); around Peterbourg, *M. Patrin s.n.* (G); Pskov Prov., Ostro Dist., Dubovsk, *N. Puring* in 1895 (MW); Moscow, *A. P. in 1888* (WU); Yaroslav Prov., Pybinsk Dist., Yremetien, Volga R., *I. I. Sapozhnikova* in 1924 (MW); Olonez Prov., Petrogavodsk Dist., Sandal Lake, *V. P. Savicz* 000944 (MW); N Dvinsk Prov., Kotles Dist., Gorodok, *E. Selevanova* in 1927 (MW); Khabarovsk Prov., Bogoradskaja, *N. & V. Shaga* 73 (MHA); S Urals near Miass, *A. K. Skvortsov* in 1950 (MO); Primorski Prov., Sutschan, Uslpachanovka, *A. K. Skvortsov* in 1967 (MO); Altai Mts., Labeled R. near Biya, *A. K. Skvortsov* in 1971 (MO); Altai Mts., N end of Teletskoye Lake, *A. K. Skvortsov* in 1971 (MO); Moscow Prov., Mozhaisk Dist., 152 km hwy Moscow-Minsk, *A. K. Skvortsov* in 1972 (MO); Caucasus Mts., Kabardino-Balkaria, Cheghem, *A. K. Skvortsov* in 1976 (MO); Laatokan Karjala, Sortavala, Malkynvuori, *N. Soyrinti* in 1929 (UBC); Pensa Prov., Pensa Dist., Arbekovo, Dvoinigory Mts., *I. I. Sprygin* in 1906 (MW); Moneron Island, *Stepanova* 230 (MHA); Vladimir Prov., Gus-Rustalny region, between Grasnoje Ecko & Dubasova, *V. Tihomirov et al.* 7661 (MW); Sachalin, Anbetsu, *Y. Tokunaga & K. Kawai* in 1929 (SAP); S Ural, vicinity of Miass, Ilmen Mts., *L. Tyulina* in 1927 (MW); Samarski Prov., Bohilovski Forest, bank of Erika R., *A. Uranov et al.* 1596 (MW); Konda, Leusch, *E. Vainio* in 1880 (TUR); Kamtchatka, Karaginskiy Island, *V. N. Voroshilov et al.* in 1969 (MHA); Primorski Prov., Svetlaya, *V. N. Voroshilov* 517 (MHA); Khabarovsk Prov., near Komsomolsk, *V. N. Voroshilov* 2073 (MO); Khabarovsk Prov., near Komsomolsk, *V. N. Voroshilov* 9073 (MHA, MO); Sachalin, Poronajsk Dist., *V. N. Voroshilov* 11500 (MHA); Leningrad Prov., Luga Dist., E shore Lake Sjaberskoja, *N. Winter* 5828 (MW); Irkutsk, Okaensi-angarensis, *without further data* (UC); Tambov Prov., Sparsskiy, Zubova-Poljana, *without collector* in 1884 (MW). UKRAINIAN S.S.R. Czernigov Prov., *Borysov* in 1859 (MW); near Thytomir, *Degener* 3497 (NY); Bukovina, Pojana-Stampi, Mt. Ascutiti, *J. Dörfler* in 1889 (WU); Zarkapatskaja Prov., Sujaljavskaja, Obava village, *K. I. Igorshina* in 1949 (MW); Kiev, near Woskrejenskaja, *I. Schmawlhausen* in 1892 (MW); Verkhovina Dist., near Burkut, Cheremosh valley, *A. K. Skvortsov* in 1968 (MO); Nizhegorodski Prov., Gorodski Dist., Kalushki, *S. Stankov et al.* in 1927 (MW); Ivano-frankovski Prov., Carpat Preserve, *V. M. Vinogradova* in 1977 (MW).

KURILE ISLANDS. Some of the Kurile Islands are claimed by Japan but occupied by the Soviet Union. Collections from this chain of islands are here listed separately. Kunashiri Island, *L. Alexeeva et al.* 5915 (MHA); Onkotan Island, Shiomiura, *S. Berman* 198 (GH, S); extreme E Shikotan Island, *B. Butovski* in 1968 (MHA); Onkotan Island, *A. Chernyaeva* in 1962 (MHA); Shumshu Island, *E. Egorova & E. Sharamova* 4183 (MHA); Kunashiri Island, Nikishoro, *K. Ito* in 1939 (SAP); Paramushir, at Shirakawa, *Y. Kudo* in 1920 (TUS); Kunashiri Island, Chishima, *Y. Matsumura* in 1930 (KYO); Shikotan Island, Mt. Shakotan-yama, *J. Ohwi* 523 (KYO); Shikotan Island, Umanose, *J. Ohwi* in 1931 (KYO); Shumshu Island, *J. Ohwi & R. Yoshii* 252 (KYO); Alide Island, Minamiura, *J. Ohwi & R. Yoshii* 5832 (KYO); Paramushir Island, *J. Ohwi & R. Yoshii* 6128 (KYO); Shikotan Island, *E. Sharamova* 3999 (MHA); Shikotan Island, Anama, *G. Tanaka & K. Miyabe* in 1910 (SAP); Urup Island, Hayakawa valley near Onsenzaki, *M. Tatewaki* in 1927 (SAP); Kunashiri Island, *V. N. Voroshilov* 10239, 10421 (MHA); Iturup Island, *V. N. Voroshilov* 10776 (MHA); Shumshu Island, *K. Yendo* in 1903 (TI).

#### ASIA

CHINA. HEBEI: Hsiaowutai-shan, *C. W. Wang s.n.* (PE). HEILONGJIANG: Dai-lin, *A. Baranov et al.* 6070 (LE). JILIN: Lialugo, *T. U. Liou* 3534 (LE); Szeping (Ssu-p'ing-chieh), Mt. Chang-pai, *C. Y. Wu & I. L. Chou* 1719 (PE). LIAONING: Between the villages of Liubzjadantzy & Sipindze, *Y. L. Chang et al.* 314 (LE); between the villages of Leuanihe & Liubzjadantzy, *S. K. Wang & Y. L. Chou* 230 (LE). "MANCHURIA": Teingan Dist., near village of Teingan, *D. Litvinov* 636 (LE).

JAPAN. HOKKAIDO: Iburi, Tomakomai Experimental Forest of Hokkaido Univ., *D. E. Boufford & E. W. Wood* 19660 (CM, KYO, MO); Abashiri, Abashiri-gun, Tsubetsu-cho, NW end of Lake Chimikeppu-ko, *D. E. Boufford & E. W. Wood* 19786 (KYO, MO); Rishiri Island, Higashirishiri-cho, Omobetsu-zawa, *D. E. Boufford & E. W. Wood* 19823 (KYO, MO); Kawakami, border of Nakagawa-cho & Otoineppu-mura on hwy 40, *D. E. Boufford & E. W. Wood* 19833 (KYO, MHA, MO); Otaru, *U. Faurie* 1184 (K, KYO, MO, P); Hidaka, Mt. Apoi, *H. Hara* in 1933 (ORE); Ishikari, Sorachi-gun,



Minamifurano-mura, Mt. Tomamu, *M. Hiroe* 6944 (TNS); Kushiro, Mt. Meakan, *S. Kitamura in 1956* (KYO); Oshima, Gamushi, *Y. Kudo in 1917* (TUS); Kitami, Rishiri, *Y. Kudo in 1916* (TUS); Nemuro, Shibetsu, *K. Miyabe in 1884* (GH); Asahikawa, Kamui-kotan, *S. Okamoto 1433* (KYO); Rebun Island, Rebun-gun, Kabuka-mura, Shireto-ko from Momoiwa, *T. Shimizu 1505* (SHIN); Ishikari, Nopporo, *T. Tanaka 243* (BM, NY, P, S, US); Mt. Daisetsu, Yukomanbetsu-Tenninkyo, *T. Yamazaki 747* (NCU, TI). HONSHU: AICHI PREFECTURE, Mt. Dando, Uratani, *K. Torii in 1960* (KANA); AKITA PREFECTURE, Kita-akita-gun, Mt. Moriyoshi-yama, *S. Kurosawa in 1959* (TI); Oga Peninsula, Motoyama, *R. Mochizuki 583* (KANA); AOMORI PREFECTURE (Mutsu), Mt. Hakkoda, *K. Okamoto 777* (A, B, BH, BM, DAO, E, G, H, K, KAG, KANA, KYO, MAK, MICH, MO, MT, MTJB, NA, NY, S, TI, TNS, TUS, UC, UPS, US, WTU); Kita-tsugaru-gun, Odomari, *K. Hosoi in 1953* (KANA); FUKUI PREFECTURE, Mt. Arashima-dake, Oono city, *G. Murata & T. Shimizu 476* (KYO); FUKUSHIMA PREFECTURE, Mt. Iide, *T. Saito T108* (TI); GIFU PREFECTURE, Masuda-gun, Osaka, *M. Mizushima in 1954* (MAK); GUNMA PREFECTURE (Kotsuke), Doai, *J. Ohwi & T. Koyama 278* (A, AA, B, BH, BM, DAO, E, G, H, K, KAG, KANA, KYO, L, MICH, MO, MT, MTJB, NA, NY, P, S, SAP, TI, TNS, TUS, UPS, US, W, WTU); Tone-gun, Katashina-mura, E side of Marunuma, *M. Ono & S. Kobayashi in 1965* (KYO, MAK, TUS); HYOGO PREFECTURE, Yabu-gun, Sekinomiya-cho, Mt. Hyonosen, *D. E. Boufford et al. 19559* (CM, G, GH, KYO, MHA, MO, PE); ISHIKAWA PREFECTURE, Hakusan, *G. Masamune 7127* (KANA); IWATE PREFECTURE, Hienuki-gun, Odagoe in Mt. Hayachine, *D. Shimidzu 12481* (TNS); KANAGAWA PREFECTURE, Hakone, Kamiyama, *M. Mizushima in 1961* (MAK); MIE PREFECTURE, Iina-gun, Myojin-daira near Mt. Kumini, *K. Seto 9865* (OSA); NAGANO PREFECTURE, en route from the summit of Mt. Choga-dake to Mitsumata, *D. E. Boufford et al. 19885* (KYO, MHA, MO); from Akagawara to Kitazawa-toge, Mt. Senjo-dake, *K. Iwatsuki et al. 116* (KYO); Kiso-gun, Mt. Ontake near Miure Dam, *M. Mizushima 10823* (S, TI); Mt. Karamatsu, *S. Okamoto in 1935* (KYO, SHIN); NARA PREFECTURE, Yoshino-gun, Mt. Omine, *T. Shimizu 4368* (S), *T. Shimizu 4408* (SHIN); NIIGATA PREFECTURE (Uzen), Nishiokitama-gun, Mt. Iide, *T. Makino MAK 6911* (S); SAITAMA PREFECTURE, Chichibu, Mt. Kobushi-dake, *K. Hisauchi 1639* (TI); SHIZUOKA PREFECTURE, S slope of Mt. Fuji-san, Omotefujinigome, *G. Murata et al. 33934* (KYO, MO); TOCHIGI PREFECTURE, Nikko city, road to Kirikomi Lake, *M. Ono & S. Kobayashi in 1963* (CAS, S, UC, US); TOTTORI PREFECTURE (Hoki), Mt. Daisen, *G. Murata in 1958* (KYO); TOYAMA PREFECTURE, Shimoshinkawa-gun, Asahi-machi, Kitamata, Mt. Iburi, *H. Kanai in 1958* (TI); WAKAYAMA PREFECTURE, Itsu-gun, Koya-cho, Mt. Koya-san, *without collector in 1912* (MAK 117703); YAMAGATA PREFECTURE, Nishiokitama-gun, Mt. Iide, *T. Makino in 1904* (S); Mt. Chokai-san, *S. Ishizuka 111* (TI); YAMANASHI PREFECTURE, W side of Mt. Fuji-san, *H. Ohba 69826* (TI). KYUSHU: FUKUOKA PREFECTURE (Busen), Togawa-gun, Mt. Eihiko, *T. Makino in 1906* (S); Tagawa-gun, Mt. Hiko-san, *T. Makino in 1906*, MAK 6901 (KAG, KYO, MAK, S); KAGOSHIMA PREFECTURE, Yakushima, Mt. Takatsuka, *S. Hatusima 14750* (KAG); Yakushima, Yaku-cho, near the summit of Mt. Miyonoura, *G. Murata & H. Tabata 454* (KYO), *M. Tagawa 1957* (KYO); KUMAMOTO PREFECTURE, Gokanosho, Mt. Kamifukune, *S. Hatusima & S. Sako 27086* (KAG, MAK); MIYAZAKI PREFECTURE, Hori & Mt. Okue, *S. Hatusima & S. Sako 24912* (KAG, KYO, MAK); Mt. Shiraiwa, *S. Hatusima & S. Sako 26330* (KAG); NAGASAKI PREFECTURE, Nagasaki, Shimabara, *C. Maximowicz in 1863* (BM, K, LE, P); OITA PREFECTURE, Mt. Kuju, Hokein, *T. Naito in 1922* (KAG); Mt. Sobo-san, *T. Naito in 1923* (KAG). SHIKOKU: EHIME PREFECTURE, Kamifua-gun, Omogo, *T. Makino in 1931* (MAK); KOCHI PREFECTURE, Kami-gun, Mt. Shiraga, *T. Makino in 1934*, MAK 6900 (KANA, MAK, S); Nanokawa, *K. Watanabe in 1884* (TI); TOKUSHIMA PREFECTURE, Mt. Tsurugi-san, *H. Kimura in 1950* (TI); Omogo, Mt. Ishizuchi, *T. Makino in 1931*, MAK 6914 (KAG, MAK, S).

KOREA, NORTH. Hamgyong-Pukto, *M. Furumi 428* (TI); Kaema-Kowon (Prov. Kannan, Kaima Plateau), *S. Kitamura in 1932* (KYO, MAK, MICH, TNS); Handae-Ri (Pyangkan-do, Handaeli), *T. Nakai 15600* (TI); Hamgyong-Namdo, S foot of Mt. Chapek-Bong, *T. Nakai 15601* (TI); Kankyo-nando, Cho-shing Co., Shing Katsu-men, *N. Namura in 1934* (KYO); Rekketsu-sui R., *J. Ohwi 2960* (BH, KYO, UPS); Hamkyongnan-do, *Y. Oikuma 372* (TI); Kyanwonpuk-do, Mt. Gumgang-san, *T. Uchiyama in 1902* (TI).

KOREA, SOUTH. Cheju-do Island (Quelpaert Island), *Chung In-cho 3898, 3899* (MICH); Cheju-do ("In forests Quelpaert"), *U. Faurie 1834* (KYO); Cheju-do (Quelpaert), *T. Mori 150* (TI); Kyongsangnam-do, Mt. Chii, *J. Mori 239* (TI); Kyongsangnam-do, Mt. Chii ("Mt. Jiili-san"), *T. Nakai in 1913* (TI); S Chulla Prov., Mt. Chii ("Chirisan"), *Mrs. R. K. Smith in 1934* (GH); Cheju-do Island ("In forests Quelpaert"), *E. Taquet 186* (KYO); Cheju-do, Hallai-san, *E. Taquet 832* (LE); Cheju-do, N in sylvis, *E. Taquet 4258* (G); Cheju-do, *E. Taquet 4298* (LE); Cheju-do Island ("Isl. Saisyu"), Kanra-san, *K. Uno 2598, 23754* (GH); Cheju-do Island ("Island of Sai-shu-to"), *without further data* (KYO). KOREA, UNKNOWN LOCALITIES: Kanhoku, Mt. Tosho, *G. Koidzumi in 1933* (MICH); Kankyo-hokudo, Minami-kegoku-san, *T. Saito 692* (KYO).

MONGOLIA. Hentiyn Nuruu Mts., bank of Minjiyn Gol R. ("Kentei Mts., Mensa R."), *N. & V. Ikonnikov-Galitzky 3201* (S, UC), 3274 (LE, UC); Hentiyn Nuruu Mts., at the Yoroo Gol R. ("Kentei

Mts. at the Tola R.''), N. & V. Ikonnikov-Galitzky 3301 (NY, S, UC); bank of the Minjiyn Gol R. above Uber-Katanse R., N. & V. Ikonnikov-Galitzky 3301 (NY, POM); Rican R., P. Mihno in 1924 (LE).

TURKEY. Coruh, Savval Tepe, above Margul, P. H. Davis & I. C. Hodge 32258 (BM, K); Pontus region, Ciganadagh, P. Sintenis 1370 (LD, WU); Pontus, Lumila, P. Sintenis 1456 (LD).

*Circaea alpina* subsp. *alpina* is by far the most wide ranging of the species of *Circaea*. Except for size, it is remarkably uniform throughout its entire range both morphologically and in ecological preferences. Size differences appear to be primarily due to local conditions of the habitat; high elevation and northern plants tending to be often considerably reduced in stature.

*Circaea alpina* subsp. *alpina* appears to be most closely related to subsp. *micrantha*, based on morphological characters, and is sometimes separated from that subspecies with difficulty. *Circaea alpina* subsp. *micrantha* grows at higher elevations (3,000–5,000 m) than subsp. *alpina* and is restricted to the high mountains in the Himalayan region and western and southwestern China. It differs from *C. alpina* subsp. *alpina* in having more coarsely dentate or serrate leaves that are usually more slender and tapering than in subsp. *alpina*. The petals in subsp. *micrantha* are often emarginate or only barely notched, the notch being 0.3 mm deep or less and less than one fifth the length of the petal. In *C. alpina* subsp. *alpina* the notch is 0.3 mm or more deep and more than one quarter the length of the petal. At anthesis the ovaries of *C. alpina* subsp. *micrantha* are glabrous, the uncinata hairs developing after the shedding of the floral tube, while in subsp. *alpina* minute hairs are present on the ovary at anthesis. Care should be taken in using the last character, however, since the numerous bundles of raphide crystals in the outer ovary walls often appear under magnification to be minute appressed hairs. *Circaea alpina* subsp. *micrantha* tends also to have the axis of the inflorescence more densely glandular-pubescent than in the majority of plants of subsp. *alpina*.

In western North America *Circaea alpina* subsp. *alpina* comes into contact with subsp. *pacifica*. Throughout much of their ranges these two subspecies remain distinct but intermediate plants occur in the Rocky Mountains, in the state of Washington, and in British Columbia. *Circaea alpina* subsp. *pacifica*, commonly a more robust plant than subsp. *alpina*, has leaves that are subentire or with only minute teeth and that are most commonly rounded at the base. The stem of subsp. *pacifica* is also coarser and bears sparse to dense falcately recurved hairs. In cases where it is difficult to assign plants to either *C. alpina* subsp. *alpina* or subsp. *pacifica* using size and leaf characters, I have tended to base my decisions on this pubescence character, calling plants with at least a few recurved hairs on the stem subsp. *pacifica* and those that are totally glabrous subsp. *alpina*.

Plants that appear to be intermediates between *Circaea alpina* subsp. *alpina* and subsp. *pacifica* set a full complement of fruits, which appear to be completely fertile. The lack of field observations and the often poor label data on specimens make it difficult to distinguish ecological differences between these two subspecies but what information is available seems to indicate that subsp. *pacifica* may often be somewhat weedy, at least near the Pacific coast where it appears in hedges and in gardens. Relatively few herbarium sheets with mixed collections of *C. alpina* subsp. *alpina* and *pacifica* exist, indicating either that the plants

are very distinct when growing together and easily separated in the field or that they rarely grow intermixed. One particularly well distributed example, however, is that of *Thompson 14701* from Big Four Inn, Snohomish County, Washington, which includes plants of both subspecies on most sheets.

In Japan, northeastern China, Far Eastern U.S.S.R., Lake Baikal, the Altai region, and in the Caucasus Mountains, *Circaea alpina* subsp. *alpina* comes in contact with subsp. *caulescens*. *Circaea alpina* subsp. *caulescens* differs from subsp. *alpina* in having larger flowers that open after elongation of the raceme axis and are held perpendicular to it, the absence of bracteoles in most instances, thicker leaves which are often pubescent above, and coarser stems that are pubescent with short, falcately recurved hairs. The stems of subsp. *caulescens* usually remain unflattened after pressing. Skvortsov (1970) has stated that he has not observed intermediates between these subspecies in any of the localities in the U.S.S.R. that he was able to observe even though they often grow near each other. In Japan, in Nagano Prefecture in central Honshu, both subspecies grow in seemingly identical habitats on adjacent moss-covered rocks at Tobira-onsen without the presence of intermediates. Both subspecies also occur on Mt. Chau-su-yama, also in Nagano Prefecture, but there *C. alpina* subsp. *alpina* is restricted to the conifer forests above 1,500 m while subsp. *caulescens* is in deciduous or mixed forests at elevations usually below 1,300 m. At Lake Chimikeppu-ko in Hokkaido both subspecies are present at the same elevation but with *C. alpina* subsp. *alpina* abundant and restricted to wet moss-covered logs and rocks and to wet seepages in deep shade, while subsp. *caulescens* is scarcer and grows in drier soil (not in moss) and is restricted to woodland margins. In neither of these locations were intermediates found. However, in southern Hokkaido at the Tomakomai Experimental Forest of Hokkaido University, a situation occurs where the majority of plants of *Circaea alpina* are intermediate between subsp. *alpina* and *caulescens*. There, both subspecies are relatively scarce, *C. alpina* subsp. *alpina* being restricted to deep shade or moss-covered rocks and logs and subsp. *caulescens* in more open areas in loose soils and as an epiphyte on the trunks of trees. The abundant intermediates are in thin second growth forests in low depressions on the forest floor and on well decayed, but not moss-covered, logs. The intermediates are fully fertile with abundant fruit set.

Other plants that appear to be intermediate between *C. alpina* subsp. *alpina* and subsp. *caulescens* are: Korea, Hamkyongnan-do, S foot of Chapek Bong, 15 August 1935, *T. Nakai 15601*, TI (this sheet represents a mixed collection of subsp. *alpina* and subsp. *caulescens* that Nakai called all subsp. *caulescens* var. *robusta*; the plants grade smoothly into each other in all characters); Korea, Keishonan-do, Mt. Chii-san, 8 August 1938, *K. Uno 23366*, GH (these plants have the thin, sharp-toothed leaves, flattened stems and very flattened petioles of subsp. *alpina* but lack bracteoles and have the stem pubescence and open inflorescence of subsp. *caulescens*). In addition, several other collections representing varying degrees of intermediacy occur.

Despite the fact that *Circaea alpina* is predominantly self-pollinating, during favorable weather the flowers are visited by numerous small insects, mostly syrphid flies and halictid bees. The chief syrphid visitors in North America are *Toxomerus geminatus* (Say) and *Melanostoma mellinum* (Linnaeus) while the

halictid visitors consist of diverse species. Rare visits by bumblebees and butterflies also occur but these visitors usually fly on quickly after visiting a single inflorescence. Both *T. geminatus* and *M. mellinum* are important visitors to the flowers of *Circaea lutetiana* subsp. *canadensis*.

*Circaea alpina* subsp. *alpina* is often confused with the hybrids formed between it and other species of the genus. Although in most cases the hybrids are more robust, morphologically they tend to resemble *C. alpina* subsp. *alpina* more closely than they do the other parental species. This is most evident in the shape and tothing of the leaves and in the succulent nature of the stem. All known hybrids involving *C. alpina* subsp. *alpina* have as the second parent species that have the nectary protruding as a fleshy disc above the opening of the floral tube, bilocular fruits, and the flowers held on pedicels that are perpendicular to the raceme axis. In *C. alpina* the nectary is always well within the floral tube, the fruit is unilocular, and the flowers are held on erect or ascending pedicels in clusters at the apex of the racemes. The hybrids always exhibit a low, but exerted, nectar-secreting disc, abortive fruits, and flowers held in an intermediate position between that of the parents or on pedicels held perpendicular to the raceme axis. The known hybrids involving *C. alpina* subsp. *alpina* include as the second parent *C. erubescens* and all subspecies of *C. lutetiana*. Hybrids between *C. alpina* subsp. *alpina* and *C. cordata* and *C. mollis* should be sought in the field. *Circaea alpina* subsp. *alpina* and *C. cordata* grow in close proximity on Hokkaido in Japan but no clear hybrids between them have been detected.

**7f. *Circaea alpina* L. subsp. *micrantha* (Skvortsov) Boufford stat. nov.** Based on *Circaea micrantha* Skvortsov, Bull. Glavn. Bot. Sada 103: 36. 1977.—FIG. 22.

Plants 0.4–2.5 dm tall. The stem glabrous or minutely pubescent, very rarely densely pubescent, with soft, short, falcately recurved hairs 0.1–0.2 mm long; the petioles glabrous or with sparse hairs as on the stem but upwardly curved; the leaves glabrous or pubescent along the veins and occasionally over the entire surface above with short falcate hairs, sometimes also with strigillose hairs intermixed; the axis of the inflorescence pubescent, often densely so, with short glandular hairs. Stem green, frequently the nodes and axes of the racemes, sometimes the entire stem, purple, soft and often conspicuously flattened in pressing and then occasionally appearing winged. Leaves pale to dark green or occasionally reddened, translucent or, less commonly, opaque; those between the middle and summit of the stem the largest, (1–)2–6.5 cm long, 0.8–4 cm wide, becoming gradually to abruptly reduced upward and ultimately bractlike and alternate, gradually to abruptly reduced downward, infrequently the leaves crowded and appearing whorled. Leaves narrowly ovate to broadly triangular, acute or very short acuminate at the apex, truncate or, more commonly, cordate at the base, sharply dentate to serrate, the teeth acutely tipped; glabrous or pubescent along the veins and occasionally also on the interveinal areas above with soft, short, falcate hairs 0.1–0.2 mm long, sometimes also with strigillose hairs, 0.1–0.3 mm long, intermixed, the undersurface glabrous or, less commonly, with short falcate hairs along the veins, the marginal cilia falcate to nearly straight, 0.1–0.3 mm long.

Petioles 0.7–2(–3) cm long, subterete to terete, commonly flattened in pressing and sometimes appearing winged, glabrous or sparsely pubescent, at least in lines above, with short, upwardly curved falcate hairs 0.1–0.2 mm long, with or without reduced branches arising in the axils. Inflorescence densely to sparsely pubescent with soft, short capitate and clavate-tipped glandular hairs 0.1–0.2 mm long, terminal on the main stem and uppermost axillary branches and occasionally at the tips of axillary branches arising at the base of the stem; green or commonly purple. The inflorescence a simple raceme or with one or two, rarely more, lateral racemes arising from the base, these subtended by reduced leaves or leaflike bracts. Flowering pedicels 0.7–1.6 mm long, glabrous or pubescent with glandular hairs as on the stem, occasionally, at maturity of the fruit, with a few uncinata hairs as on the fruit extending downward near the apex; ascending or erect, the flowers opening before elongation of the raceme and clustered at the tip; with a setaceous bracteole 0.1–0.3 mm long at the base. Fruiting pedicels 2–3.5 mm long. Buds glabrous, from the summit of the ovary, 0.9–1.6 mm long, 0.4–0.5 mm thick, white or pink, often purple tinged apically and occasionally purple throughout, ovate to broadly elliptic or obovate in outline, minutely mammiform or rounded at the apex. Ovary 0.6–1.2 mm long, 0.4–0.5 mm thick, elliptic, clavate or obovate in outline, glabrous or very rarely, with minute uncinata hairs at anthesis. Floral tube appearing as a mere constriction at the summit of the ovary to 0.4 mm long, ca. 0.2 mm thick at the narrowest point, broadly to very broadly funnelform. Sepals 0.8–1.5 mm long, 0.6–0.9 mm wide; white or pink, often tinged with purple at the apex and occasionally purple throughout, ovate to broadly ovate to oblong ovate, rounded or minutely mammiform at the apex. Petals 0.6–1.5 mm long, 0.6–1 mm wide, longer than wide, white or pink, obtriangular to obovate in outline; the apical notch absent or to 0.3 mm deep, to  $\frac{1}{5}$  the length of the petal; the petal lobes, when present, truncate to rounded. Filaments 0.7–1 mm long; anthers 0.2–0.3 mm long, 0.2–0.3 mm deep. Style 0.6–1.4 mm long; stigma 0.1–0.3 mm tall, 0.2–0.4 mm thick. Mature fruit clavate, rounded at the apex, 2.2–2.7 mm long, 0.8–1(–1.2) mm thick; the uncinata hairs 0.4–0.5 mm long, translucent and clear or occasionally containing purple pigment. Combined length of pedicel and mature fruit 4–6(–7.5) mm long. Gametic chromosome number, unknown.

TYPE: China, Gansu, at the temple of Tcheibsen-hit, 9,000 ft, 30 August 1901, *V. Ladygin 514* (LE, holotype).

Distribution (Fig. 21): Moist places, grassy alpine areas, thickets and coniferous forests at high elevations. Western China and northern Burma through the Himalayas to northwestern India. Between 3,100–5,000 m. Flowers, early June to mid-September and sporadically to mid-October.

#### Specimens examined:

BHUTAN. Rarder, *R. E. Cooper 784* (E); Zado La Gimpu, *R. E. Cooper 2733* (BM, E); Singhi Kivited, *R. E. Cooper 4299* (BM, E); Gafoola, upper Pho Chu, *F. Ludlow et al. 16745* (BM, E, G, UPS); Rudd La, *F. Ludlow et al. 20969* (BM).

BURMA. Maikaba-Salween divide, Mt. Chimi-li, *G. Forrest 24965* (E, NY, P, US, W).

CHINA. GANSU: Xiahe Hsien, *K. T. Fu 1048* (PE); temple of Tcheibsen-hit, *V. Ladygin 514* (LE); Xigu Hsien, *T. P. Wang 1446* (PE). SICHUAN: Pinwu Hsien, *K. L. Chu 3791* (NAS); Dege, *S. X. Jia 226* (PE); Quanning Hsien, *X. Li 5716, 5798, 5801* (PE); Dege, *X. Li 7398* (PE); Litang Hsien, *X. Li*

74248, 74337 (PE); O-pien Hsien, *S. L. Sharg 1069* (US); Dongrergo, Kuan-yin-miao, *H. Smith 3605* (S, UPS); Dara-tha-phong, *J. A. Soulie 94* (K); Take Hsien, *Take Exped. 7398* (PE); Pinwu Hsien, *H. L. Tsiang 10889* (NAS); Barkam Hsien, *C. L. Wu 32039, 32728* (PE); Ebian Hsien, *Z. W. Yao 2784, 4343* (PE); Leibo Hsien, *T. T. Yü 3811* (PE). XIZANG (TIBET): Mekong valley near Chor-chiu R., *V. Ladygin 522* (LE); Kongbo Prov., Tumbatse, Rong Chu, *F. Ludlow et al. 5106* (BM, E, UPS); Nyingchi Hsien, *Nyingchi Exped. 751269* (PE); Yadong Hsien, *Quinghai-Xizang Exped. 742476* (PE); Ka-lung-yuan ("Karloug" or "Kalungan"), *H. Smith 4113* (LD, S, UPS); Taofu dist., Haintze-shan, *H. Smith 11343* (S, UPS); Sog Hsien, *D. D. Tao 11008* (PE); Cona Hsien, *C. Y. Wu 751104* (PE); Chang'yab, *Xizang Scien. Exped. 12271* (PE); Riwage, *Xizang Scien. Exped. 12829* (PE); Bomi Hsien, *J. S. Yang & T. Y. Hong 867* (PE). YUNNAN: Fang-yang-ch'ung, *J. M. Delavay in 1887* (P); Tsawarung, Chi-na-tang, *C. W. Wang 65343* (A, NAS, PE); War-Kar-boo, *C. W. Wang 66270* (NAS); Weixi Hsien, Yeh-chih, *C. W. Wang 68463* (A, NAS, PE); Huan-fu-ping, A-tun-tze, *C. W. Wang 68863* (NAS); Degen, *C. W. Wang 69079* (PE); Techen Hsien, Huan-fu-ping, A-tun-tze, *C. W. Wang 69725* (A, NAS, PE).

INDIA. SIKKIM: Yeumthang, Zemu & Lhonakh valleys, *G. H. Cave 173/47* (E); Lachung Valley, Yeumtang, *G. A. Gammie 782* (MIN); "Sikkim, 9–12,000 ft.," *J. D. Hooker s.n.* (BM, G, GOET, L, P, S, W); Kaljonuie, *Dr. King's collector in 1888* (W); Zemu Valley, *Smith & G. H. Cave 1680* (B). STATE UNKNOWN: Bashar, above Chasu, *J. H. Lace 400* (E).

NEPAL. Tudam, *Beer et al. 8376* (BM); Jangla Banyang, *E. Einarsson et al. 3385* (BM, L); Singalila, Sandakphu, Kalapokhari, *H. Hara et al. 69916* (TI); Singalila, Mt. Singalila, *H. Hara et al. 69917* (TI); Lari, *A. Maire 404* (BM); between Mouma & Wallun chun Gola, *K. Nishioka 1253* (KYO); Khola Kharka, *O. Polunin 1069* (BM); Thakurji Lekh, S of Jumla, *O. Polunin et al. 4754* (BM, E, UPS); near Sirtibang Lekh, *J. D. A. Stainton et al. 3453* (BM, E); Annapurna Himal., Tati Khola, *J. D. A. Stainton et al. 6676* (BM); Bhararate Himal., Barun valley, Yangle pasture, *T. Wraber 317, 334* (BM).

PAKISTAN. Chon, Thana, *without collector in 1871* (LIV).

*Circaea alpina* subsp. *micrantha* differs from subsp. *alpina* only in minor ways. Skvortsov (1977), in describing *C. alpina* subsp. *micrantha* as a new species, pointed out these differences, which include generally smaller floral parts, entire to barely emarginate petals with the apical notch one-fifth or less the length of the petal, glabrous ovaries at anthesis, usually densely glandular inflorescence axis, and leaves that are generally more slender and tapering and more coarsely dentate or serrate than in subsp. *alpina*. The whitened or pale undersurface of the leaves is not restricted to subsp. *micrantha* as Skvortsov suggests. Although plants referred here to *C. alpina* subsp. *micrantha* have in the past been considered the same as subsp. *alpina*, it seems best to treat the two as distinct, at least until experimental data are available.

*Circaea alpina* subsp. *micrantha* grows at higher elevations than any of the other subspecies of *C. alpina* and is restricted to the Himalayan region and the mountains of western and southwestern China. As delimited here, the range of *C. alpina* subsp. *micrantha* is isolated from that of subsp. *alpina* by nearly 1,000 km and overlaps aerially the ranges of subspp. *angustifolia* and *imaicola*. For the most part, it is separated from the latter two altitudinally.

#### INTERSPECIFIC HYBRIDS

The following are descriptions and discussions of the known hybrids in *Circaea*. Hybrids involving the bilocular species of *Circaea*, arranged in alphabetical order of the parental species, are treated first followed by hybrids involving the unilocular members of the genus.

Three hybrids (*Circaea* × *decepiens*, *C.* × *mentiens* and *C.* × *skvortsovii*), for which sufficient evidence is available to determine their parentage with cer-

tainty, are given formal names in keeping with the precedent set by the naming of *C. × dubia*, *C. × intermedia* and *C. × ovata*. The remaining hybrids are in need of more detailed field work to confirm the suspected parentage and are here listed under the hybrid combination of the probable parents.

*Circaea × dubia* Hara (*Circaea cordata* Royle × *Circaea erubescens* Franchat & Savat.), Bot. Mag. Tokyo 50: 306. 1936.—FIG. 27.

Morphologically intermediate between *Circaea cordata* and *C. erubescens*. Erect, rarely decumbent at the base, 2–10(–15) dm tall, simple or freely branched above, forming vigorous, long, often branched, rhizomes which give rise to the following year's plants from their tips. Plants sparsely to densely pubescent; the stem with soft, short, falcately recurved hairs, 0.2–0.4 mm long; the inflorescence with short, capitate and clavate-tipped, glandular hairs or short falcately recurved hairs as on the stem, or these intermixed, also with a few long, straight or slightly curved, sharp pointed, soft hairs, 0.4–1 mm long; the petioles with upwardly curved falcate hairs as on the stem; the leaves with pubescence as on the petioles and also with scattered, long, straight hairs, 0.7–1.2 mm long. Stem green, the nodes purple. Leaves horizontally spreading, usually drooping at the tips, green, opaque; those slightly above the middle of the stem the largest, 5.5–15 cm long, 3.5–8.5 cm wide; becoming gradually reduced in size upward to the inflorescence and eventually bractlike and alternate, gradually reduced in size downward (although not always apparent since the lower leaves are usually deciduous by flowering time); narrowly to broadly ovate, short to long acuminate at the apex, rounded to subcordate at the base, denticulate; densely pubescent, at least above; the veins with falcate hairs, 0.2–0.4 mm long, and with long, slightly curved or straight hairs, 0.7–1.2 mm long; the interveinal areas with short, falcate hairs, 0.2–0.3 mm long, and/or with erect or strigillose hairs, 0.2–0.4 mm long; the margins with dense falcate cilia, 0.1–0.2 mm long, and/or with straight or slightly curved hairs, 0.2–0.4 mm long. Petioles 3–6(–7.5) cm long, densely pubescent with upwardly curved, falcate hairs, 0.2–0.4 mm long and with longer, straight or slightly curved hairs, 0.3–0.5 mm long, sometimes also with long, straight, sharp pointed, soft hairs, 0.7–1.1 mm long, intermixed; often with reduced branches arising in the axils. Inflorescence sparsely to densely pubescent with short, capitate and clavate tipped, glandular hairs, 0.1–0.2 mm long, or with falcately recurved hairs, 0.2–0.5 mm long, or with an admixture of the two, occasionally also with long, straight or slightly curved, patent hairs, 0.7–1.2 mm long, intermixed; terminal on the main stem and often at the tips of the uppermost axillary branches; the racemes simple or branched at the base, the lower branches alternate or opposite and subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, 1–2 cm long at initiation of flowering, to 12(–18) cm long at cessation of flowering; the lateral racemes ca. 2–3 cm long at initiation of flowering, to 8(–15) cm long at cessation of flowering, subequal to variable in length on the same plant. Flowering pedicels 1.1–2.8 mm long, perpendicular to the axis of the raceme, glabrous or pubescent, with short capitate and clavate-tipped, glandular hairs, 0.1–0.2 mm long, and occasionally with long, straight hairs, 0.4–1 mm long, with a setaceous bracteole, 0.1–0.7 mm long, at the base; closely spaced, the flowers clustered near the apex

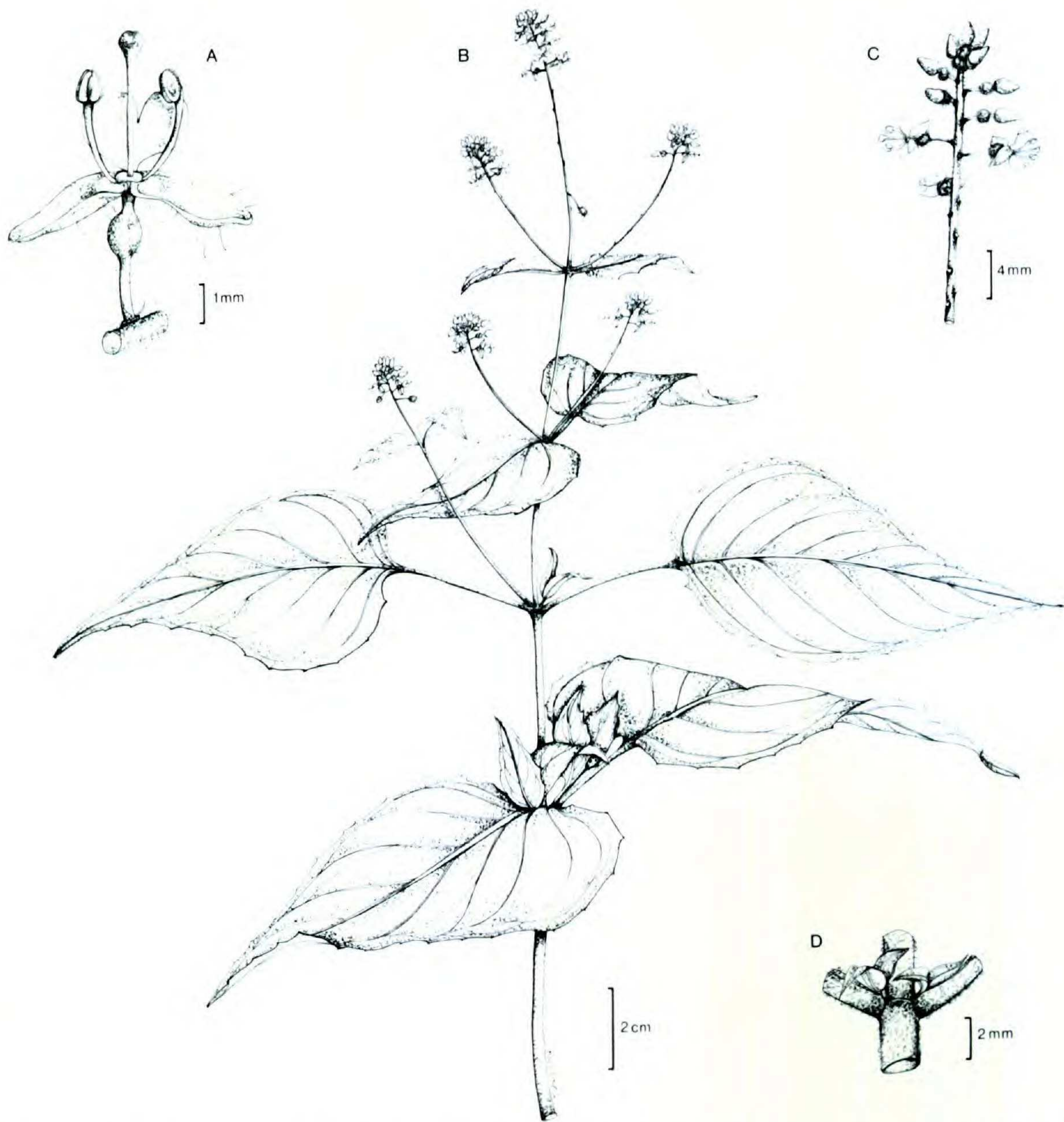


FIGURE 27. *Circaea* × *dubia* Hara (*C. cordata* Royle × *C. erubescens* Franchet & Savat.).—A. Flower with petal removed; note low, exserted nectary.—B. Upper flowering stem.—C. Inflorescence. Upper node of stem. From Boufford et al. 19578 (MO).

of the raceme. Fruiting pedicels developing to 2.7 mm long before abortion of the fruits. Buds glabrescent to pubescent, with short, glandular hairs ca. 0.1 mm long and/or with long, sharp pointed, straight or abruptly bent hairs, 0.5–0.9 mm long; white, pink or very pale green; narrowly to broadly elliptic or oblong in outline, rounded gradually or acuminate to the obtuse or minutely mammiform apex; from the summit of the ovary, 2.6–3.6 mm long just prior to anthesis. Ovary 1.1–1.8 mm long, 0.6–1.9 mm thick at anthesis, very thickly lenticular to pyriform, very densely covered with soft, translucent, uncinuate hairs. Floral tube 0.6–0.9 mm long, 0.1–0.2 mm thick at the narrowest point, funnellform or the sides tapering concavely to the ovary, glabrous or pubescent, with short glandular hairs and/or with long straight hairs as on the buds. Sepals 1.9–2.9 mm long, 0.8–1.9 mm wide, glabrous or pubescent on the abaxial surface with hairs as on the buds;



white or pink; lanceolate oblong to very broadly elliptic or broadly oblong, gradually rounded to long acuminate to the minutely mammiform or obtuse apex, divergent to reflexed in flower. Petals 1.3–2.2 mm long, 1.2–2.2 mm wide, more commonly wider than long, white or pink, obovate, obdeltoid to transverse obovate in outline; the apical notch 0.4–0.9 mm deep,  $\frac{1}{3}$ – $\frac{1}{2}$ , rarely more, the length of the petal, the petal lobes rounded to minutely crenulate. Stamens spreading at anthesis, shorter than or occasionally equalling the style; filaments 1.2–2.7 mm long; anthers 0.5–0.7 mm long, 0.3–0.5 mm thick. Style erect, straight or slightly drooping at the tip, 3.4–4.3 mm long, topped by an obconic to transverse, narrowly oblong, prominently bilobed stigma, 0.3–0.5 mm tall, 0.4–0.7 mm thick. Nectar secreting disc present as a low exerted ring at the summit of the floral tube, ca. 0.1 mm tall, 0.3–0.6 mm thick, more obvious in living plants. Mature fruit very rarely developing, when present, 2.2–3.2 mm long, 1.5–2.5 mm thick, thickly lenticular to flattened pyriform to obovoid, often with one or both seeds failing to develop to maturity; bilocular, without prominent ribs or sulci, densely covered with stiff, translucent, uncinuate hairs, 0.8–1.1 mm long, and with shorter, capitate and clavate-tipped, glandular hairs. Fruiting pedicels, when present, slightly reflexed. Gametic chromosome number,  $n = 11$  (9 bivalents plus a ring or chain of 4 at meiosis).

TYPE: Japan, Hokkaido, Hidaka-shicho, in forests near Shoya, 11 August 1934, *H. Hara C4689* (TI, holotype).

Distribution: Sporadic but often abundant in naturally, rarely man-caused, disturbed areas; commonly along streams, in broad-leaved temperate deciduous forests. Hokkaido, and Honshu, Japan; northeastern China. From near sea level to ca. 1,500 m. Flowers, mid-July to late August, rarely into September.

#### Representative specimens examined:

CHINA: Manchuria, 1941, *no further data* (MAK). JAPAN. HOKKAIDO: Abashiri-shicho, along the Okoppe-gawa River at the Sako-hashii bridge, *D. E. Boufford & E. W. Wood 19798* (BM, CAS, CM, E, G, K, KYO, MHA, MO, P, SHIN). Abashiri-shicho, Okoppe-cho, 15.9 km NE of Nishiokoppe on hwy 239, *D. E. Boufford & E. W. Wood 19806* (KYO, MHA, MO). Hidaka-shicho, forests near Shoya, *H. Hara C4689* (TI). Hidaka-shicho, Samani-gun, Samani-cho, Okada, *D. E. Boufford & E. W. Wood 19697* (BM, C, CAN, CAS, CM, E, G, GH, K, KYO, LD, LE, MA MHA, MICH, MO, NCU, NY, P, PE, S, SHIN, TUS, UC). Ishikari-shicho, Sapporo city, Mt. Teine-yama, *H. Yanagirawa in 1915* (SAPS). Kawakami-shicho, hwy 40 just WNW of Osashima at border of Nakagawa-cho, *D. E. Boufford & E. W. Wood 19830* (KYO, MO). HONSHU: FUKUSHIMA PREFECTURE, Nishigo-mura, Iwaki, *S. Suzuki* (TNS 42101), Nishi-shirakawa-gun, Saigo-mura, Saigo-cho, *T. Suzuki in 1933* (KYO). HYOGO PREFECTURE, Yabu-gun, Sekinomiya-cho, en route from Fukusada to the summit of Mt. Hyonosen, *G. Murata 21100* (KYO), (Tajima Province), Mt. Hyonosen, *S. Kitamura & G. Murata 634* (KYO), Mikata-gun, Onsen-cho, Kiri-taki waterfall, *G. Murata 20683* (KYO), *D. E. Boufford, E. W. Wood & K. Iwatsuki 19595* (BM, CM, E, G, GH, K, KYO, LD, MHA, NCU, P, PE, S, SHIN, TI, TUS, UC), Yabu-gun, Oya-cho, Ikada, Ten-taki waterfall, *G. Murata 22071* (KYO), *D. E. Boufford, E. W. Wood & K. Iwatsuki 19584* (CM, KYO, MO), Shiso-gun, Haga-cho, Tokura, *G. Murata 20364* (KYO, MAK, TI, TNS), *D. E. Boufford, E. W. Wood & K. Iwatsuki 19587* (BM, CM, G, K, KYO, MHA, MO, NCU, PE, SHIN, TUS). IWATE PREFECTURE, Kawanuma-gun, Kanagami-mura, Iwashiro, *in 1893* (TNS 32183). NAGANO PREFECTURE, Chino city, Oyayu, *in 1925* (MAK 117793), Shinano, Mt. Kirigamine, *H. Takei* (TNS 117073), Shinano, Mt. Tateshima, *H. Takei* (TNS 106456), Kita-saku-gun, Asama, *M. Goto* (MAK 117769), Minami-saku-gun, Mt. Goza, Yamaguchi-michi, *H. Hara in 1958* (TI), Nichino, Kaida village, Kiso, *M. Mizushima in 1953* (TI), Shiraiwadake, Miwa-mura, *S. Korayama in 1958* (TI), Kamiina-gun, Miwa-mura, Todai, *G. Murata 7999* (KYO, SAPS). NIGATA PREFECTURE, Minami-uonuma-gun, Mimata-mura, Yagi-sawa, *K. Teramoto in 1946* (TI). SHIZUOKA PREFECTURE, Mt. Fuji-san, Maotenjin, *B. Hayata in 1924* (TI). TOCHIGI

PREFECTURE, Nasu, (cultivated) *H. Hara in 1957* (TI). TOKUSHIMA PREFECTURE, Miyoshi-gun, Mikamo-machi, Sajiki-toge pass, *M. Takafuji 864* (KYO). TOTTORI PREFECTURE, Iwami-gun, Hokubu-cho, Mt. Ojinosen, *A. Tanaka 20556* (KYO). YAMANASHI PREFECTURE, Yamanaka-ko Lake, foot of Mt. Fuji-san, *B. Hayata in 1929* (TI). SHIKOKU: KOCHI PREFECTURE (Tosa Province), Nanogawamura, *K. Watanabe* (TNS 53627), Tosa-gun, Tosayama-mura, Mt. Kuichi, *T. Yamanaka 43169, 46786* (TNS), *T. Makino in 1887* (MAK 6950). Toyobishi, no further data, *S. Hori* (MAK 117750).

*Circaea* × *dubia* (*C. cordata* × *C. erubescens*) is by far the most common hybrid of *Circaea* in Japan and perhaps in all of eastern Asia. Its occurrence in Japan parallels the situation in North America and Europe where hybrids between *C. alpina* and *C. lutetiana* are often found in the absence of one or both parental species. *Circaea* × *dubia* is most common along, but not restricted to, stream margins where frequent flood waters often remove less aggressive plants. *Circaea* × *dubia* occurs commonly in the zone between the lowest waters of the summer and the highest spring floods and may extend along streams for several kilometers, as along the Okkoppo-gawa River in north-central Hokkaido. Other habitats in which *C. × dubia* may be found are in alluvial woods in low depressions that have been scoured clean of other vegetation by flooding and in seepages in man-made or natural clearings. *Circaea* × *dubia* is intermediate in habitat preference between *C. cordata* and *C. erubescens*.

Hara (1936, 1959) has pointed out the morphological intermediacy of *Circaea* × *dubia* between *C. cordata* and *C. erubescens*. Despite its intermediate nature, *C. × dubia* is highly variable from population to population and is especially variable in degrees of pubescence. The buds especially may vary from glabrescent to densely pubescent. All plants of *C. × dubia* have at least a few of the long, soft hairs of *C. cordata* mixed in with shorter falcate hairs on the stem, leaves or inflorescence axes. *Circaea* × *dubia* also resembles *C. cordata* in its often robust habit, general leaf shape, and in the relatively close spacing the flowers at anthesis. The petals, also, are similar to those of *C. cordata* in shape although in color they are often pink as in *C. erubescens*. *Circaea* × *dubia* resembles *C. erubescens* in having an exserted, but often very low and inconspicuous, ringlike, nectar-secreting disc, and in having the nodes purple. Degree of pubescence is highly variable on the inflorescence axes and on the pedicels. In some plants the inflorescence is nearly glabrous while in others it is densely pubescent. Similarly, the stem also varies in degrees of pubescence, but never to the extent of the inflorescence. The sepals resemble more often those of *C. cordata*, which are broadly to very broadly elliptic or oblong, than those of *C. erubescens*, which tend to be lanceolate and short to long tapering or acuminate at the apex. The ovaries are more commonly like those in *C. cordata* in being thickly lenticular and very densely uncinately pubescent, yet the ovaries that develop closest to maturity are most often obovate and similar in shape to those of *C. erubescens*.

Pollen fertility in *Circaea* × *dubia* averaged ca. 9% fertile, ranging from 1.6 to 17.5%, with mostly normal, 3-pored grains, in 16,506 grains examined.

*Circaea* × *skvortsovii* Boufford, hybrid nov., = *Circaea cordata* Royle × *Circaea lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Magnus.—FIG. 28.

*Circaea cordatae* Royle simile, in nectario exsertio differt, et *C. lutetiana* L. subsp. *quadrisulcatae* (Maxim.) Asch. & Magnus. simile, sed in caule pubenti differt.

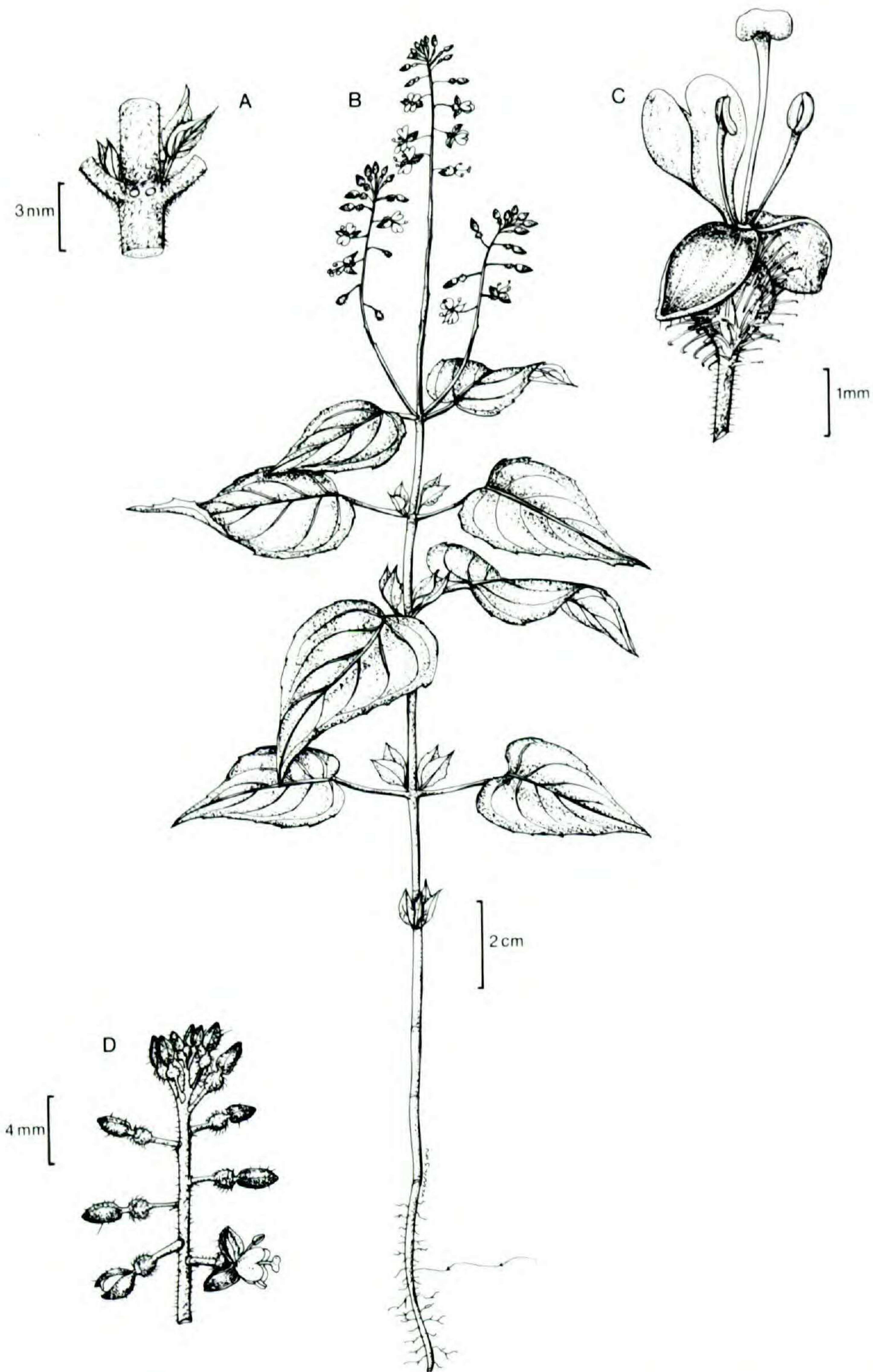


FIGURE 28. *Circaea* × *skvortsovii* Boufford (*C. cordata* Royle × *C. lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Magnus.—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note low, exserted nectary.—D. Inflorescence. From Alexeeva in 1973 (MHA).

Morphologically intermediate between *Circaea cordata* and *C. lutetiana* subsp. *quadrisulcata*. Erect, 2.2–6 dm tall, simple below the inflorescence, forming long, non-tuberous rhizomes which give rise to the following year's plants from their tips. Plants sparsely to densely pubescent; the stem with soft, short, falcately recurved hairs ca. 0.2 mm long and with occasional long, straight or slightly

curved, patent hairs to ca. 0.8 mm long; the inflorescence with soft, short, capitate and clavate-tipped, glandular hairs, 0.2–0.3 mm long and with a few, long, straight or slightly curved, patent hairs, 0.4–0.8 mm long intermixed; the petioles with upwardly curved falcate hairs, 0.2–0.4 mm long, these continuing along both surfaces of the leaf, the leaf also with short, straight, soft hairs ca. 0.2 mm long, these appearing strigillose in pressed specimens. Stem green. Leaves horizontally spreading, flat or drooping at the tips, green or slightly grayish, opaque; those slightly above the middle of the stem the largest, 4.5–6.5 cm long, 2.5–3.5 cm wide; becoming gradually reduced in size upward and eventually bractlike and alternate in the lower part of the inflorescence, gradually reduced in size downward (although not always apparent since the lower leaves are usually deciduous by flowering time); narrowly to broadly ovate to oblong ovate, short-acuminate at the apex, truncate to subcordate or cordate at the base, denticulate, sparsely to densely pubescent; the leaf margins with straight and falcate cilia, 0.2–0.4 mm long. Petioles 1.2–4 cm long, densely pubescent with upwardly curved, falcate hairs, 0.2–0.4 mm long; with reduced branches arising in the axils. Inflorescence densely pubescent with glandular hairs, 0.2–0.3 mm long, and with long, straight or slightly curved, patent hairs, 0.4–0.8 mm long; terminal on the main stem and less frequently (?) at the tips of the uppermost axillary branches, the racemes simple or, more commonly, branched at the base, when branched, the branches commonly alternate, subtended by reduced leaves or leaflike bracts; the terminal raceme, from the uppermost reduced leaf or leaf-like bract, ca. 1.5 cm long at initiation of flowering, to ca. 10 cm long at cessation of flowering; the lateral racemes ca. 2 cm long at initiation of flowering, to ca. 6 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels 1.8–3 mm long, perpendicular to the axis of the raceme, pubescent with short, capitate and clavate-tipped, glandular hairs, 0.2–0.3 mm long, and with a few straight or slightly curved, sharp pointed hairs to ca. 0.5 mm long;  $\pm$  closely spaced, the flowers clustered near the apex of the raceme; with a setaceous, sometimes caducous bracteole, 0.2–0.4 mm long, at the base. Fruiting pedicels apparently failing to develop. Buds pubescent with short, glandular hairs, 0.1–0.2 mm long; purple, except for the floral tube, broadly elliptic oblong to oblong in outline, rounded to the obtuse or minutely mammiform apex, from the summit of the ovary, 2.4–3.2 mm long, 1.2–1.3 mm thick just prior to anthesis. Ovary 1.1–1.7 mm long, 1–1.5 mm thick at anthesis, thickly lenticular to flattened obovate, very densely covered with soft, short, translucent, uncinuate hairs. Floral tube 0.4–0.5 mm long, 0.2–0.3 mm thick at the narrowest point, subcylindric to broadly funnelform, pubescent, with glandular hairs, 0.1–0.2 mm long. Sepals 2.2–2.8 mm long, 1.4–1.6 mm wide, pubescent on the abaxial surface with hairs as on the buds; pink or purple. Broadly elliptic oblong to oblong ovate, rounded to the obtuse or minutely mammiform apex, divergent to reflexed in flower. Petals 1.6–2.4 mm long, 2–2.4 mm wide, commonly wider than long, pink or white, depressed broadly obovate in outline; the apical notch 1–1.3 mm deep, from slightly less to slightly more than  $\frac{1}{2}$  the length of the petal; the petal lobes broadly rounded. Stamens spreading at anthesis, shorter than to nearly equalling the style; filaments 1.5–2 mm long; anthers 0.4–0.5 mm long, ca. 0.4 mm thick. Style straight, erect, ca. 3.2 mm long, topped by an obconic to transversely oblong, often prominently

bilobed stigma, 0.4–0.5 mm tall, 0.6–1 mm thick. Nectar-secreting disc present as a low ring at the summit of the floral tube, ca. 0.1 mm tall, 0.3–0.5 mm thick, more obvious in living material. Mature fruit not seen. Ovary bilocular and 2-seeded, the seeds evidently not fertile. Gametic chromosome number, unknown.

TYPE: U.S.S.R., Sakhalin, Moneron Island (Kaibato), 16 August 1973, *L. Alexeeva s.n.* (MHA, holotype).

Distribution: Disturbed habitats. Northeastern China, Far Eastern U.S.S.R. and northern Japan. Flowers, August.

Representative specimens examined:

CHINA. HEBEI: Hsiang-shan region, *H. Sheehan 462* (NY). Chili, Trappist Monastery, *J. Liu 1024* (UC). "MANCHURIA," Korean Gate ("Korii-mon") *Kitagawa in 1931* (TI). JAPAN. HONSHU: IWATE PREFECTURE: Shimohei-gun, Mt. Hachine, *T. Makino in 1905* (MAK 6953). U.S.S.R.: Sakhalin, Moneron Island (Kaibato), *Alexeeva in 1973* (MHA), *E. Egorova 2533* (MHA).

*Circaea* × *skvortsovii* (*Circaea cordata* × *C. lutetiana* subsp. *quadrisulcata*) is most obviously intermediate between the two parents in degree and nature of the pubescence and in the morphology of the floral parts. It is similar to *C. cordata* in having long, sharp pointed, straight or slightly curved patent hairs occurring sporadically on various parts of the plant and in having the stem pubescent. In color of the buds, sepals, and petals, in the presence of a low, exserted nectary projecting beyond the opening of the floral tube, and in the dense glandular pubescence of the inflorescence axis, it is similar to *C. lutetiana* subsp. *quadrisulcata*, but in shape of petals and relatively close spacing of the flowers it is more like *C. cordata*. The presence of a setaceous bracteole at the base of the pedicels in this hybrid is also characteristic of *C. cordata*.

*Circaea* × *ovata* (Honda) Boufford stat. nov. (*Circaea cordata* Royle × *Circaea mollis* Siebold & Zucc.). Based on *C. quadrisulcata* (Maxim.) Franchet & Savat. var. *ovata* Honda, Bot. Mag. Tokyo 46: 3. 1932.—FIG. 29.

*Circaea mollis* Siebold & Zucc. var. *ovata* (Honda) Hara, J. Jap. Bot. 10: 598. 1934.

Morphologically intermediate between *Circaea cordata* and *C. mollis*. Erect, 3–1.3 dm tall, simple or freely-branched above, forming long, often branched, non-tuberous rhizomes which give rise to the following year's plants from their tips. Plants densely pubescent; the stem grayish or whitish green with short and long falcately recurved hairs, 0.2–0.4 mm long; the inflorescence with hairs as on the stem and occasionally with long, straight or slightly curved, sharp pointed, soft hairs, 0.4–1.1 mm long and sometimes also with short, capitate and clavate tipped, glandular hairs, 0.1–0.2 mm long; the petioles with upwardly curved falcate hairs as on the stem and often also with long, straight or slightly curved hairs, 0.4–1.1 mm long, the falcate hairs continuing along the main veins of the leaf, at least above, the interveinal areas with erect straight hairs, 0.2–0.4 mm long, these appearing strigillose in pressed specimens, and often also with short falcate hairs intermixed. Stem green or grayish, the nodes purple. Leaves horizontally spreading, drooping at the tips, green or grayish, opaque; those slightly

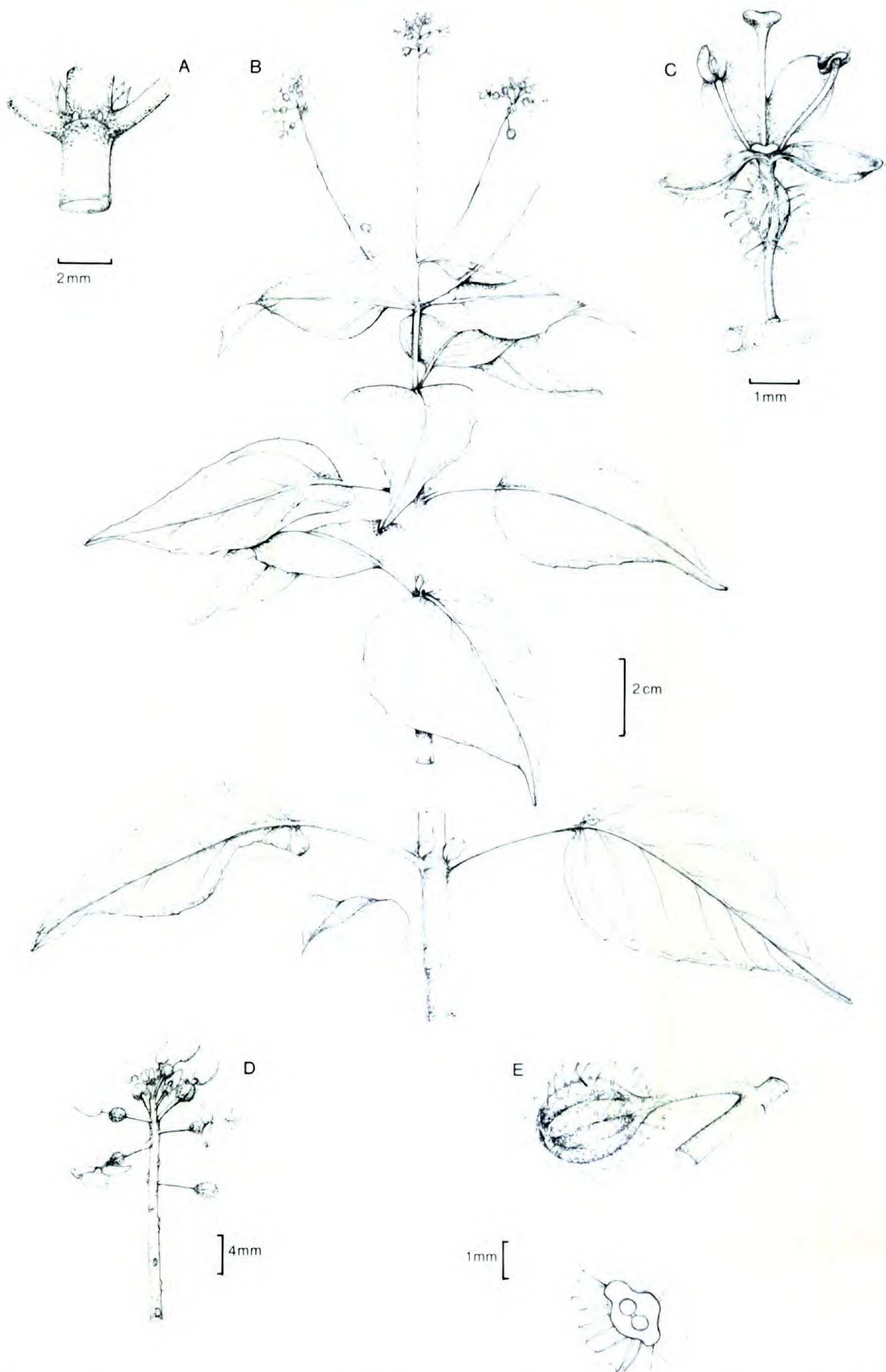


FIGURE 29. *Circaea*  $\times$  *ovata* (Honda) Boufford (*C. cordata* Royle  $\times$  *C. mollis* Siebold & Zucc.).—A. Mid-stem node.—B. Mid and upper flowering stem.—C. Flower with petal removed; note low, exserted nectary.—D. Inflorescence.—E. Developing fruit. From Boufford & Wood 19855 (K, KYO, MHA, MO, S, SHIN).

above the middle of the stem the largest, 7–12 cm long, 4–6.5 cm wide; becoming very gradually reduced in size upward and eventually bractlike and alternate in the lower part of the inflorescence, gradually reduced in size downward (although not always apparent since the lowest leaves are usually deciduous by flowering time); ovate lanceolate to ovate, short to long acuminate at the apex, rounded or, less commonly, subcordate at the base, denticulate, sometimes very minutely so; densely pubescent, with hairs as on the petiole continuing along the veins and also often on the interveinal areas, at least above, the interveinal areas also with erect, straight hairs, 0.2–0.4 mm long, these often appearing strigillose in pressed specimens; the leaf margins with short falcate cilia, ca. 0.2 mm long, and with longer, straight or slightly curved hairs, 0.2–0.4 mm long. Petioles 1.5–6 cm long, densely pubescent with upwardly curved, falcate hairs, 0.1–0.4 mm long, and often with longer, straight or slightly curved hairs, 0.4–0.9 mm long intermixed; with reduced branches arising in the axils. Inflorescence densely pubescent with short, falcately recurved hairs, 0.1–0.2 mm long and longer, slightly recurved hairs, 0.2–0.4 mm long, often with long, straight, sharp pointed hairs, 0.4–1 mm long intermixed, less commonly also with short, glandular hairs, 0.1–0.2 mm long; terminal on the main stem and often at the tips of the uppermost axillary branches or directly from the uppermost leaf axils, the racemes simple or branched at the base, when branched, the branches commonly opposite or subopposite, subtended by reduced leaves or leaflike bracts; the terminal raceme, from the uppermost reduced leaf or leaflike bract, ca. 2 cm long at initiation of flowering, to ca. 12 cm long at cessation of flowering; the lateral racemes 1.5–3 cm long at initiation of flowering, to ca. 9 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels 1.1–2.8 mm long, perpendicular to the axis of the raceme, pubescent with short, glandular hairs, 0.1–0.2 mm long, and often with short, falcately recurved hairs, 0.1–0.2 mm long; closely spaced, the flowers clustered near the apex of the raceme; with a setaceous, sometimes caducous, bracteole, 0.3–0.6 mm long, at the base. Fruiting pedicels developing to ca. 2.7 mm long before abortion of the fruits. Buds pubescent with short glandular hairs, 0.1–0.2 mm long, and occasionally also with long, straight or slightly curved hairs, to ca. 0.5 mm long; white or pale green, very broadly elliptic to subcircular in outline, rounded to the obtuse tip; from the summit of the ovary, 2.6–2.8 mm long, 1.1–1.4 mm thick just prior to anthesis. Ovary 1.2–2.1 mm long, 0.9–1.8 mm thick at anthesis, thickly lenticular to flattened obovoid, very densely covered with soft, translucent, uncinuate hairs. Floral tube 0.5–0.7 mm long, 0.1–0.35 mm thick at the narrowest point, funnellform, pubescent with short glandular hairs, 0.1–0.2 mm long. Sepals 1.9–3.2 mm long, 1.1–1.9 mm wide, pubescent on the abaxial surface with hairs as on the buds, white or very pale green, oblong to very broadly elliptic, rounded to the obtuse apex, divergent to reflexed in flower. Petals 1.8–2.4 mm long, 1.9–2.6 mm wide, wider than long, white, broadly obovate to depressed obovate in outline; the apical notch 0.6–1.1 mm deep,  $\frac{1}{3}$ – $\frac{1}{2}$  the length of the petal; the petal lobes rounded, often broadly so. Stamens spreading at anthesis, shorter than, to equaling the style; filaments 2–3 mm long; anthers ca. 0.6 mm long, ca. 0.5 mm thick. Style straight, erect, 2.9–4 mm long, topped by an obconic to very narrow, transversely oblong, bilobed stigma, 0.2–0.4 mm tall, 0.6–1.4 mm thick. Nectar se-

creting disc present as a low ring at the summit of the floral tube, ca. 0.1 mm tall, 0.5–0.6 mm thick, more obvious in living material. Mature fruit very rarely developing, when present, 3.3–3.5 mm long, 2.4–2.5 mm thick, thickly lenticular to flattened, broadly obovoid, with low ribs and very shallow sulci; appearing intermediate between fruits of *Circaea cordata* and *C. mollis*; bilocular and 2-seeded, one or both seeds commonly failing to develop; densely covered with stiff, translucent, uncinuate hairs ca. 0.9 mm long and with shorter, glandular hairs ca. 0.1 mm long. Fruiting pedicels, when present, sharply reflexed. Combined length of pedicel and mature fruit developing to ca. 6.5 mm long. Gametic chromosome number,  $n = 11$  (9 bivalents plus a ring or chain of 4 at meiosis).

TYPE: Japan, Honshu, Tochigi Prefecture, Kamitsuga-gun, Higashioashi-mura, Mt. Futamata, 1931, *H. Sekimoto 13* (TI, holotype).

Distribution: Local in natural and man-made disturbed areas in temperate deciduous forests and *Cryptomeria* plantations. Japan, Hokkaido, and central and northern Honshu and the southern Kurile Islands (Kunashiri, one collection); China. From ca. 50 to 1,500 m. Flowers, late July to early September.

#### Representative specimens examined:

CHINA. SICHUAN: Nan-ch'uan, Chin-fo-shan, Chu-lung-chiao, *K. F. Li in 1957* (PE 537839). Yunnan-sen, *J. Cavalerie 212* (E). JAPAN. HOKKAIDO: Ishikari-shicho, Sapporo city, Mt. Maruyama, *M. Hara in 1942* (TI), *D. E. Boufford & E. W. Wood 19855* (K, KYO, MHA, MO, S, SHIN). Ishikari-shicho, Otaru city, I-jima, *S. Mimoro in 1975* (KYO). Ishikari-shicho, Sapporo city, Mt. Teine-yama, *Y. Takahashi in 1917* (SAPS). Shiribeshi-shicho, Yoichi, *T. Yamamoto 4428* (KYO). HONSHU: GUNMA PREFECTURE, Ose, Nebasawa, *J. Ohwi & M. Tagawa 706* (KYO). IWATE PREFECTURE, Morioka city, *G. Toba 638* (TI). KANAGAWA PREFECTURE, Yokosuka, *L. Savatier 412* (P, S). NAGANO PREFECTURE, Kiso, Mt. Ontake-san, *G. Koizumi in 1910* (TI). NIIGATA PREFECTURE, Kiyotsu-kyo, Nakauonuma-gun, *S. Kobayashi 12862* (KYO, S). SHIGA PREFECTURE, Mt. Ibuki-yama, *J. Nakai in 1910* (MAK). TOKYO PREFECTURE, Mt. Dokan-yama, *T. Makino in 1888* (MAK 6951), (Musashi Province), Nishitama-gun, Mt. Kariyose, *T. Makino in 1930* (S). YAMAGATA PREFECTURE, Higashine city, *D. E. Boufford & E. W. Wood 19881* (K, KYO, MO, NY, P, UC). KURILE ARCHIPELAGO. Kunashiri Island, *L. Alexeeva 5423* (MHA). SOUTH KOREA. Keisyonan-do, Mt. Chii-san, *K. Uno 23114a* (GH).

*Circaea* × *ovata* is totally intermediate between *C. cordata* and *C. mollis*. Next to *C. × dubia* (*C. cordata* × *C. erubescens*), this is the most common hybrid of *Circaea* in eastern Asia. Unlike the situation in *C. × dubia* where either or both parents may be absent in the presence of the hybrid, *C. × ovata* appears to occur only in areas where the two parents are found together, and then only if a suitable disturbed habitat is available. A single exception may be the collection of Alexeeva (MHA) from Kunashiri Island in the Kurile Archipelago, which appears to be this hybrid. *Circaea mollis* has yet to be collected in the Kuriles but *C. cordata* is present there. Unfortunately, most label data on *C. × ovata* fail to indicate whether or not other species are growing nearby. It will be necessary for those in a position to do so to carry on additional field work in order to determine how widespread this hybrid is and whether or not it definitely occurs in the absence of the parents.

Individual plants in a population of *Circaea* × *ovata* are remarkably similar morphologically although different populations may be quite variable, as is the case in all hybrids of *Circaea*, suggesting that hybrids are formed relatively infrequently and spread primarily by vegetative means when they are formed.



*Circaea* × *ovata* differs from *C. cordata* in having the nodes darkened, in the presence of a low, ringlike disc projecting above the floral tube and in having pubescence consisting of mostly curved rather than straight hairs. From *C. mollis*, *C. × ovata* differs in having longer recurved hairs as well as a few straight, sharp pointed hairs on at least some part of the plant, in having the nectar-secreting disc greatly reduced in height and in having the coloration of the nodes reduced in intensity. In shape of petals, ovaries (and fruits when they develop), and leaves, *C. × ovata* is intermediate between the two parents.

*Circaea* × *ovata* resembles hybrids between *C. cordata* and *C. lutetiana* subsp. *quadrisulcata* but the latter generally has the inflorescence more densely glandular-pubescent, the leaves oblong-ovate and more often subcordate to cordate at the base and buds that are often purple or pink. *C. × ovata* has a more southerly distribution than *C. cordata* × *C. lutetiana* subsp. *quadrisulcata* but there is some overlap of ranges in Hokkaido.

Pollen fertility in *C. × ovata* averages 4.2% and ranges from 0.85% to 24% in the specimens examined.

*Circaea* × *decepiens* Boufford, hybrid nov. = *Circaea erubescens* Franchet & Savat. × *Circaea lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Magnus.—FIG. 30.

*Circaea erubescens* Franchet & Savat. simile, in petalis profundioribus incis, lobis rotundatis differt, et *C. lutetiana* L. subsp. *quadrisulcatae* (Maxim.) Asch. & Magnus simile, in inflorescentia pubescentia sparsiore differt.

Resembling *Circaea* × *dubia* (*C. cordata* × *C. erubescens*) but glabrous; intermediate between *Circaea erubescens* and *C. lutetiana* subsp. *quadrisulcata*. Erect or decumbent at the base and rooting at the nodes, 4–9.5 dm tall, simple below the inflorescence, forming non-tuberous rhizomes which give rise to the following year's plants from their tips. Plants almost totally glabrous; the stem glabrous or with a few, short, falcately recurved hairs ca. 0.2 mm long; the petioles with similar but upwardly curved, sparse hairs; the inflorescence axes with short, capitate and clavate-tipped glandular hairs 0.1–0.2 mm long, these sometimes very sparse. Stem green, the nodes purple. Leaves horizontally spreading, drooping at the tips, green, opaque; those between the middle and upper part of the stem the largest, 7–10.5 cm long, 4.5–6.5 cm wide; becoming gradually reduced in size upward to the inflorescence and eventually bractlike and remaining opposite, less commonly alternate; gradually reduced in size downward (but not always apparent since the lower leaves are usually deciduous by flowering time); oblong lanceolate to ovate to broadly so to oblong ovate, acuminate at the apex, very broadly cuneate to rounded or truncate at the base, denticulate, very sparsely pubescent above with short, falcate hairs ca. 0.2 mm long; the margins with slightly curved or falcate cilia, 0.2–0.4 mm long. Petioles 3–5 cm long, sparsely pubescent with upwardly curved, falcate or slightly curved cilia, 0.2–0.4 mm long; most often without reduced branches arising in the axils. Inflorescence essentially glabrous to densely pubescent, often varying from one raceme to another on the same plant, with short, capitate and clavate-tipped, glandular hairs; terminal on the main stem and often from the axils of the uppermost leaves; the racemes simple or the terminal raceme with lateral branches

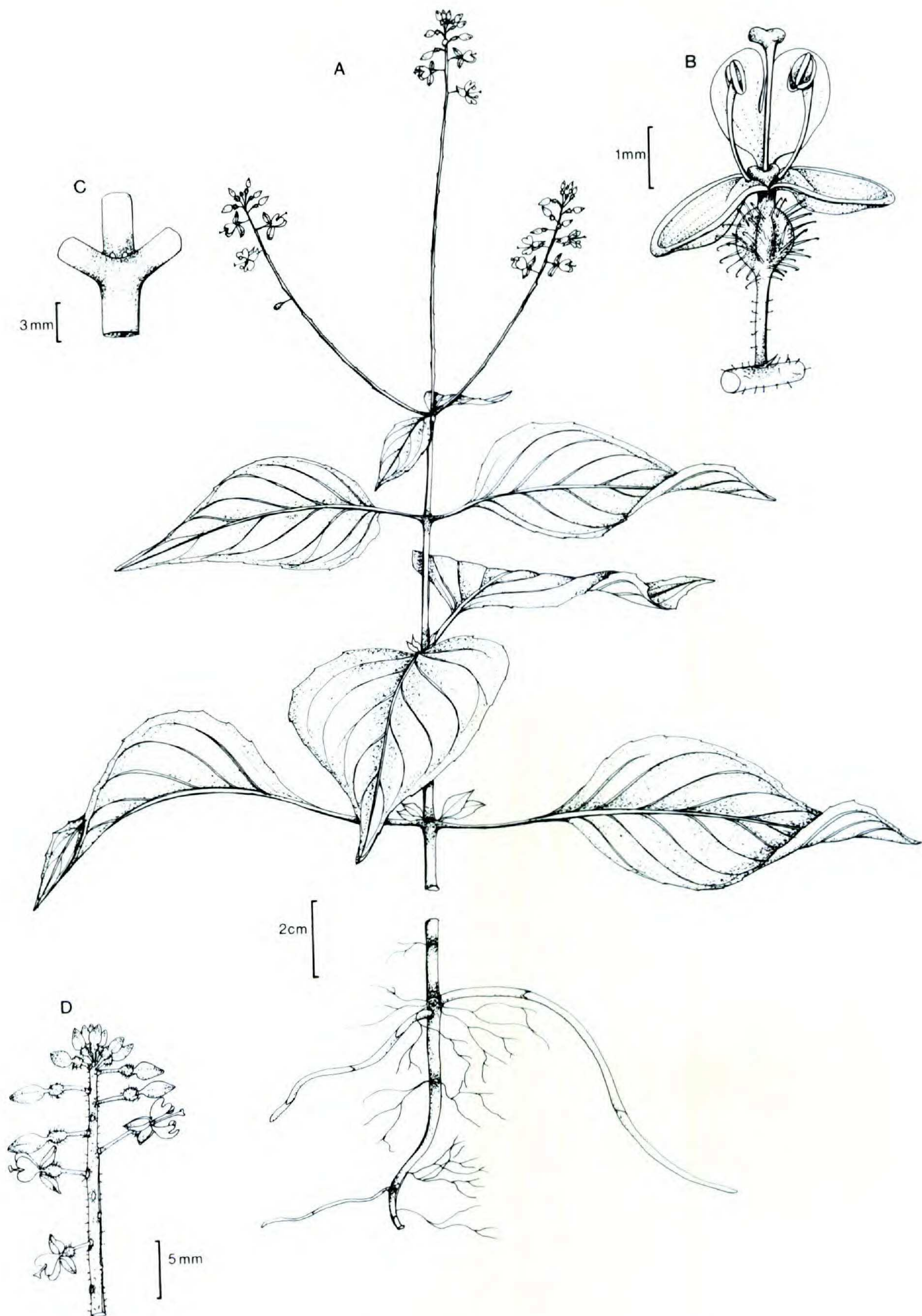


FIGURE 30. *Circaea* × *decipiens* Boufford (*C. erubescens* Franchet & Savat. × *C. lutetiana* L. subsp. *quadrisulcata* (Maxim.) Asch. & Magnus.—A. Upper and lower portions of flowering stem.—B. Flower; note exserted nectary.—C. Node of upper stem.—D. Inflorescence. From Boufford & Wood 19717 (KYO, MO).

arising from the base, these most commonly opposite or subopposite and subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, to 15 cm long at cessation of flowering; the lateral racemes to 11 cm long at cessation of flowering, subequal to variable in length on the same plant. Flowering pedicels 1.7–2.3 mm long, perpendicular to the axis of the raceme, subglabrous to, more commonly, glandular pubescent with hairs as on the raceme axes, most commonly with a minute setaceous bracteole to 0.4 mm long at the base. Fruiting pedicels very rarely developing. Buds glabrous to pubescent, with short, capitate and clavate-tipped, glandular hairs ca. 0.1 mm long; pink or purple; oblong to very broadly elliptic in outline, rounded to acuminate at the apex; from the summit of the ovary, 2.8–4.7 mm long, 1.6–1.8 mm thick just prior to anthesis. Ovary 1–1.3 mm long, 0.6–1 mm thick at anthesis, obovoid to pyriform, densely pubescent with soft, translucent, uncinata hairs. Floral tube 0.6–0.8 mm long, ca. 0.2 mm thick at the narrowest point, funnelform, glabrous or pubescent with hairs as on the buds. Sepals 2.3–3.7 mm long, 1.4–1.8 mm wide, glabrous or pubescent abaxially with hairs as on the buds; pink or purple; oblong to oblong ovate, rounded or acuminate to the obtuse apex, reflexed in flower. Petals 1.8–2.5 mm long, 1.8–3 mm wide, most commonly wider than long, white or pink, obovate to transversely broadly obovate in outline; the apical notch 0.8–1 mm deep,  $\frac{1}{3}$  to nearly  $\frac{1}{2}$  the length of the petal; the petal lobes rounded. Stamens spreading at anthesis, shorter than the style; filaments 1.7–2 mm long; anthers 0.6–0.8 mm long, 0.5–0.6 mm thick. Style erect, straight, 3.2–3.9 mm long, topped by a transversely oblong, bilobed stigma, 0.3–0.4 mm tall, 0.5–1 mm thick. Nectar-secreting disc present as a low ring at the summit of the floral tube, 0.1–0.3 mm tall, ca. 0.5 mm thick. Mature fruit most often failing to develop, the ovaries aborting shortly after the falling of the hypanthium, when present, to ca. 2.5 mm long, to ca. 1.8 mm thick, pyriform, with or without shallow sulci, bilocular and 2-seeded, rarely both seeds fertile, densely covered with stiff, translucent, uncinata hairs. Combined length of pedicel and mature fruit, to ca. 9.5 mm long. Gametic chromosome number,  $n = 11$  (9 bivalents plus a ring or chain of 4 at meiosis).

TYPE: Japan, Hokkaido, Hidaka-shicho, Samani-gun, Samani-cho, Okada, 21 August 1977, *D. E. Boufford & E. W. Wood 19717* (MO, holotype; CM, GH, K, KYO, MHA, MICH, NCU, NY, P, S, SHIN, UC, isotypes).

Distribution: Along streams in mixed deciduous or deciduous-coniferous forests. Known only from Hokkaido, Japan. Occurring below 200 m. Flowers, late July to late August.

#### Representative specimens examined:

JAPAN. HOKKAIDO: Hidaka-shicho, Samani-gun, Sumani-cho, Okada, *D. E. Boufford & E. W. Wood 19717* (CM, GH, K, KYO, MHA, MICH, MO, NCU, NY, P, S, SHIN, UC). Kushiro-shicho, Kushiro, Onbetsu. *M. Nakamura s.n.* (SAPS). Nikuppu, *S. Nogawa s.n.* (SAPS). One collection labelled only "Yezo" without further information (TI).

*Circaea* × *decipiens* (*C. erubescens* × *C. lutetiana* subsp. *quadrisulcata*) resembles *C. × dubia* (*C. cordata* × *C. erubescens*) but differs in several important features. *Circaea* × *decipiens* lacks the long, patent hairs found

in *C. × dubia* and *C. cordata* and is either glabrous or has only sparse pubescence on the stem below the inflorescence. The inflorescence bears only short, glandular hairs as in *C. lutetiana* subsp. *quadrisulcata*. However, in some plants of the hybrids, the glandular pubescence may be extremely sparse, which is never the case in *C. lutetiana*. The purple coloring of the buds and sepals is pronounced in *C. erubescens × C. lutetiana* subsp. *quadrisulcata* whereas in *C. × dubia* the buds and sepals are paler and may be white, green, or pink. The darkened nodes in *C. × dubia* are dull in appearance due to the often dense pubescence while in *C. erubescens × C. lutetiana* subsp. *quadrisulcata*, which has glabrous stems, the nodes are darkened and shining in live plants.

This hybrid differs from *Circaea erubescens* in having the petals more deeply notched, in having at least a few glandular hairs in the inflorescence and in having petal lobes that are rounded. From *C. lutetiana* subsp. *quadrisulcata* it differs in having the number of glandular hairs in the inflorescence often greatly reduced in density and in having the nodes conspicuously purple. A puzzling feature is that the nectar-secreting disc in the hybrid is often considerably shorter than in either parent. Another interesting feature of *C. × decipiens* is that, in some populations, the glandular hairs may be very dense on one raceme branch while nearly lacking on another on the same plant.

As with other hybrids in the genus, *C. × decipiens* needs some form of disturbance to become established. At Samani, Hokkaido, the hybrid grows approximately 50 m downstream from a mixed population of the two parents in an area subject to frequent disturbance from flooding, but at Kyoto University's Shibeche Experimental Forest no hybrids are found in an undisturbed deciduous forest despite the fact that *C. erubescens* and *C. lutetiana* subsp. *quadrisulcata* are abundant and grow intermixed.

Pollen fertility in *Circaea erubescens × C. lutetiana* subsp. *quadrisulcata* averages 8.2%, ranging from 4.4 to 8.8%, with mostly normal, 3-pored grains. One specimen labelled only "Hokkaido" ("Yezo"), and without collector or date (TI), and not included in the above averages, had all the pollen sterile in 355 grains examined.

*Circaea erubescens* Franchet & Savat. × *Circaea mollis* Siebold & Zucc.

Intermediate between *Circaea erubescens* and *C. mollis* but in habit often resembling one parent more than the other. Erect, 4–8 dm tall, simple or branched above, forming long, non-tuberous rhizomes which give rise to the following year's plants from their tips. Plants densely to sparsely pubescent; the stem with short, soft, falcately recurved hairs, 0.2–0.3 mm long; the inflorescence with a few capitate and clavate-tipped glandular hairs, ca. 0.2 mm long, and also with sparse falcately recurved hairs as on the stem, especially below; the petioles with sparse to dense falcate hairs as on the stem but these upwardly curved, these continuing along the main veins of the leaves or the leaves, except the margins, glabrous, leaf margins with short falcate cilia. Stem, green, the nodes purple. Leaves horizontally spreading, drooping at the tips, green or slightly reddened, opaque; those between the middle and the upper part of the stem the largest, 5–9 cm long, 2.7–4.5 cm wide, becoming gradually reduced in size upward and eventually bractlike and alternate in the lower part of the inflorescence; gradually reduced

in size downward; lanceolate to ovate lanceolate, not at all or only slightly acuminate at the apex, rounded at the base, denticulate to subentire, glabrous or pubescent with soft, short, falcate hairs, these most often restricted to the veins; leaf margins with short, falcate cilia ca. 0.2 mm long. Petioles 1–4 cm long, very sparsely to densely pubescent with upwardly curved, falcate hairs and a few straight hairs, ca. 0.2 mm long, with or without reduced branches arising in the axils. Inflorescence very sparsely pubescent with a few capitate and clavate-tipped, glandular hairs, ca. 0.2 mm long, occasionally with soft, falcately recurved hairs as on the stem, terminal on the main stem and at the tips of the uppermost reduced branches, less commonly arising also from the nodes, the branches commonly alternate, subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, ca. 2 cm long at initiation of flowering, to ca. 10 cm long at cessation of flowering; the lateral racemes 1–2 cm long at initiation of flowering, to ca. 7 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels 1.6–3.5 mm long, perpendicular to the axis of the raceme, sparsely pubescent with a few glandular hairs, ca. 0.2 mm long, without or very rarely with a minute setaceous bracteole at the base. Fruiting pedicels developing to ca. 4.5 mm long before abortion of the fruit. Buds glabrous or glabrescent with glandular hairs ca. 0.1 mm long; green and often purple tinged or purple; oblong ovate to oblong obovate in outline, rounded to slightly acuminate to the obtuse apex; from the summit of the ovary, 2.5–2.9 mm long, 1.1–1.2 mm thick just prior to anthesis. Ovary 1.1–1.7 mm long, 0.8–1.1 mm thick at anthesis, obovoid, densely pubescent with soft, translucent, uncinuate hairs. Floral tube 0.6–0.9 mm long, ca. 0.2 mm thick at the narrowest point, narrowly funnelform. Sepals 2–3.2 mm long, 1.2–1.4 mm wide, glabrous or glabrescent abaxially with hairs as on the buds; green or purple; oblong to oblong lanceolate, rounded or slightly acuminate to the obtuse apex, reflexed in flower. Petals 1.1–1.8 mm long, 1.2–1.6 mm wide, longer than wide, white or pink, obdeltoid to obovate in outline; the apical notch 0.3–0.6 mm deep,  $\frac{1}{4}$  to slightly over  $\frac{1}{3}$  the length of the petal; the petal lobes truncate or rounded, occasionally minutely crenulate. Stamens spreading at anthesis, shorter than, to as long as the style; filaments 1.3–2 mm long; anthers 0.4–0.6 mm long, 0.4–0.5 mm thick. Style erect, straight, 2.2–3.4 mm long, topped by a usually prominently bilobed, obtriangular to transversely oblong stigma, 0.3–0.5 mm tall, 0.6–0.9 mm thick. Mature fruit developing to ca. 2.7 mm long, 1.9 mm thick, usually aborting shortly after the falling of the hypanthium, obovoid, with low ribs and shallow sulci, bilocular and 2-seeded, rarely the seeds fertile; densely covered with stiff, translucent, uncinuate hairs, ca. 0.7 mm long. Combined length of pedicel and most mature fruit, 8.5 mm long. Gametic chromosome number, unknown.

Distribution: Roadsides, pastures and other disturbed habitats. Local and rare (?) on Hokkaido and Honshu, Japan.

#### Representative specimens examined:

JAPAN. HOKKAIDO: Mombetsu-gun, Tokinoue-cho, Oshira-neppu, *S. Okamoto s.n.* (KYO). HONSHU: SHIZUOKA PREFECTURE, Fujinomiya-shi, Mt. Fuji-san, Mura-kami, *I. Kato s.n.* (MAK 117770). TOCHIGI PREFECTURE, Nikko, *T. Makino s.n.* (MAK 6943, KANA). Bukojo to Takodate, *H. Fox s.n.* (BM). One collection labelled only "Japan, 20 July" (GH).

*Circaea erubescens* × *C. mollis* is intermediate between the two parents in several critical features but often, in overall appearance, resembles one parent more closely than the other, making identification difficult. The petals in the hybrid are more shallowly notched than in *C. mollis* and tend to have lobes that are often truncate or broadly rounded and minutely crenulate, reminiscent of *C. erubescens*. The nodes of *C. erubescens* × *C. mollis* are a deeper purple than in *C. mollis* but not as deep as in *C. erubescens*. The leaf bases are rounded in the hybrid and the leaves vary in shape from lanceolate to nearly ovate. The flowering pedicels in *C. erubescens* × *C. mollis* are nearly as short as in *C. mollis* and shorter than in *C. erubescens*. Familiarity with the parental species is extremely helpful in recognizing the hybrid.

The apparent rarity of *Circaea erubescens* × *C. mollis* is unexplainable. *Circaea erubescens* and *C. mollis* are the two most common and widespread species of the genus in Japan and China and often grow in close proximity to one another. Experimental attempts to produce this hybrid as well as further field work to locate additional populations should be carried out.

Pollen fertility in *Circaea erubescens* × *C. mollis* averages 5.3%, ranging from 0% to 13.9%, with all normal, 3-pored grains.

*Circaea* × *mentiens* Boufford, hybrid nov. = *Circaea alpina* L. subsp. *alpina* × *Circaea erubescens* Franchet & Savat.—FIG. 31.

*Circaea alpina* L. subsp. *alpinae* simile, in nectario exsertio differt, et *C. erubescens* Franchet & Savat. simile, in petalis profundioribus incisus ut in *C. alpina* differt.

Morphologically intermediate between *Circaea alpina* subsp. *alpina* and *C. erubescens*. Erect or decumbent at the base and rooting at the nodes, 1.2–3 dm tall, simple or, less frequently, branched above, forming numerous filiform rhizomes similar to those in *C. alpina* but never tuberous and only slightly thickened apically. Plants completely glabrous except for unciniate hairs on the ovaries and minute falcate cilia on the petioles and leaf margins. Stem green, the nodes purple, very conspicuously so in life and then appearing succulent. Leaves horizontally spreading, usually drooping at the tips, pale to dark green, nearly opaque to translucent; those near the summit of the stem the largest, 2.5–7 cm long, 1.7–4 cm wide; becoming very abruptly reduced in size at the base of the inflorescence and ultimately bractlike and alternate, gradually reduced in size downward; ovate to very broadly so, rarely subcircular, acute to short acuminate at the apex, truncate to cordate at the base, denticulate to prominently serrate; with minute, falcate cilia along the margins. Petioles 1.7–3.5 cm long, terete to subterete, glabrous or with upwardly curved, falcate cilia in lines along the upper surface. Inflorescence terminal on the main stem and less often at the tips of axillary branches; the racemes simple or branched at the base, the branches alternate, subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost leaf or leaflike bract, to ca. 10 cm long at cessation of flowering; the lateral racemes commonly shorter than the terminal but occasionally to 10 cm long, subequal to variable in length on the same plant. Flowering pedicels 1.5–3.2 mm long, perpendicular to the axis of the raceme to slightly ascending, the flowers opening after elongation of the raceme; with a setaceous bracteole, 0.2–

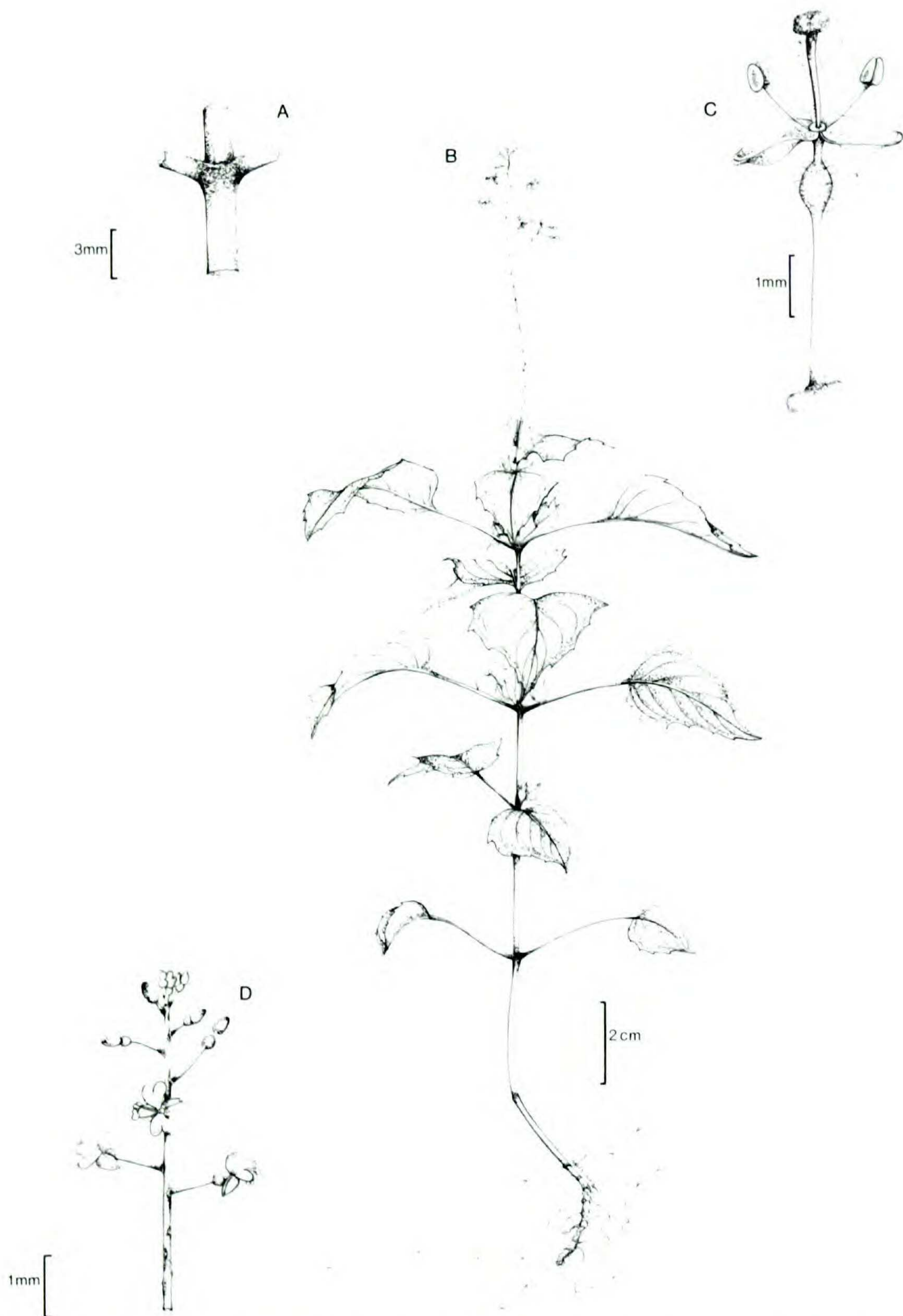


FIGURE 31. *Circaea* × *mentiens* Boufford (*C. alpina* L. subsp. *alpina* × *C. erubescens* Franchet & Savat.).—A. Mid-stem node.—B. Habit.—C. Flower with petal removed; note low exserted nectary.—D. Inflorescence. From Boufford & Wood 19633 (CM, KYO, MO, SHIN, UC).

0.4 mm long at the base. Fruiting pedicels failing to develop. Buds elliptic to broadly so to ovate or obovate in outline, gradually rounded to short acuminate to the obtuse apex; from the summit of the ovary, 1.4–2.2 mm long, 0.7–1 mm long just prior to anthesis. Ovary 0.7–1 mm long, 0.3–0.7 mm thick at anthesis,

elliptic, clavate to obovate in outline, covered with soft, translucent, uncinuate hairs. Floral tube 0.3–0.5 mm long, 0.1–0.2 mm thick at the narrowest point, funnellform. Sepals 1–1.7 mm long, 0.6–0.8 mm wide, white or pink; narrowly oblong, oblong lanceolate to broadly elliptic, gradually rounded to short acuminate to the obtuse apex, reflexed in flower. Petals 1.1–1.8 mm long, 0.8–1.4 mm wide, longer than wide, white or pale pink, narrowly obtriangular to broadly obovate in outline; the apical notch 0.2–0.4 mm deep,  $\frac{1}{5}$ – $\frac{1}{3}$  the length of the petal; the petal lobes rounded to obliquely deltoid. Stamens erect or spreading at anthesis, commonly equaling the style: filaments 0.7–1.4 mm long; anthers 0.4–0.5 mm long, ca. 0.3 mm thick. Style erect, straight, 1.5–2.2 mm long, topped by an obconic to transversely oblong, prominently bilobed stigma, 0.2–0.3 mm tall, 0.3–0.5 mm thick. Nectar-secreting disc present as a low, exerted ring at the summit of the floral tube, to 0.1 mm long, ca. 0.2–0.3 mm thick, more obvious in living plants. Mature fruits failing to develop, the ovary aborting shortly after anthesis. Gametic chromosome number,  $n = 11$  (11 bivalents at meiosis).

TYPE: Japan, Hokkaido, Ishikari-shicho, Sapporo city, Mt. Maruyama, 17 August 1977, *D. E. Boufford & E. W. Wood 19633* (MO, holotype; CM, KYO, SHIN, UC, isotypes).

Distribution: Rocky stream margins and moist, naturally disturbed areas in temperate and mixed deciduous-coniferous forests. Hokkaido and Sado Island, Niigata Prefecture, Japan. From 20 to 200 m. Flowers, late July to mid-September.

#### Representative specimens examined:

JAPAN. HOKKAIDO: Abashiri-shicho, Yubetsu-cho, 1.6 km E of Engaru-cho on hwy 147, *D. E. Boufford & E. W. Wood 19795* (G, GH, K, KYO, MHA, MO, NCU, NY, S, SHIN). Iburishicho, Tomakomai Experimental Forest of Hokkaido University, *D. E. Boufford & E. W. Wood 19661* (KYO, MO). Ishikari-shicho, Sapporo city, Mt. Maruyama, *D. E. Boufford & E. W. Wood 19633* (CM, KYO, MO, SHIN, UC). Tokachi-shicho, Hiro ("Forets d-Biro"), *U. Faurie 4842* (P). HONSHU: Niigata Prefecture, Sado Island, Aoneiba-goe, *F. Maekawa 5113* (TI).

Based on past collections, *Circaea* × *mentiens* (*C. alpina* subsp. *alpina* × *C. erubescens*) appears to be rare and local in its occurrence. This assumption may be only partially correct for in the space of three weeks I was able to find three additional populations in three widely scattered areas on Hokkaido, Japan. The lack of more collections of this hybrid may be due largely to the fact that colonies of this plant often remain vegetative or produce only a very few inconspicuous flowering shoots. These non-flowering colonies are no doubt passed over as sterile plants of *C. alpina* subsp. *alpina* which the hybrid closely resembles.

*Circaea* × *mentiens* bears some resemblance to the hybrid *C. × intermedia* (*C. alpina* subsp. *alpina* × *C. lutetiana*) but the former has the leaves more distantly and evenly spaced and has a more spindly appearance as in *C. erubescens*. In *C. × mentiens* the leaves are not drastically different in size as they often are in other hybrids involving *C. alpina*, the nodes are a very deep reddish purple and very succulent and shining in living plants and the axis of the inflorescence is glabrous. Also, the branches of the inflorescence tend to be more lax and divergent as in *C. erubescens* rather than stiffly ascending as in other species and hybrids. The flowers in this hybrid are intermediate between the two parents.



The apical notch of the petals varies between being very shallow as in *C. erubescens* and moderately deep as in *C. alpina* subsp. *alpina*. A very low, ringlike nectary projects slightly above the opening of the floral tube. This latter feature is much more evident in living plants than in dried herbarium specimens where some shrinkage of the nectary occurs. The flowers in *C. × mentiens* open after the raceme axis elongates and are borne on rather loosely spaced, divergent to ascending pedicels.

The ovaries fail to develop in *Circaea × mentiens* and abort shortly after the falling of the floral tube. Pollen fertility averages less than 1% with mostly regular, 3-pored grains in plants examined.

*Circaea × intermedia* Ehrh., pro sp., Beitr. zur Naturkunde 4: 42. 1789. = *C. alpina* L. × *C. lutetiana* L.—FIG. 32.

*Circaea lutetiana* L. var. *intermedia* Hornem., Dansk Dec. Plantl. 25. 1806.

*Circaea alpina* L. β *major* Schrader, Fl. Germ. 1: 14. 1806.

*Circaea lutetiana* L. β *intermedia* (Ehrh.) Wahlenb., Fl. Suec. 1: 4. 1824.

*Circaea × intermedia* Ehrh. forma *inaequialta* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.

*Circaea × intermedia* Ehrh. forma *aequialta* Lasch, Linnaea 2: 446. 1827. TYPE: E. Germany, Neumark.

*Circaea alpina* L. β *intermedia* (Ehrh.) DC., Prodr. 3: 63. 1828.

*Circaea lutetiana* L. β *glabra* Soyer-Willemet, Obser. 151. 1828.

*Circaea alpino-lutetiana* G. Meyer, Chl. Hanover 100. 1836. Based on *C. × intermedia* Ehrh.

*Circaea lutetiano-alpina* G. Meyer, Chl. Hanover 101. 1836. Based on *C. × intermedia* Ehrh.

*Circaea alpestris* Wallroth, Fl. Hercyn. 109. 1840. Nom. subs., *C. × intermedia* Ehrh. in syn.

*Circaea alpina* L. β *sterilis* Döll, Rheinische Fl. 746. 1843. Nom. subs., *C. × intermedia* Ehrh. in syn.

*Ocimastrum intermedium* (Ehrh.) Rupr., Fl. Ingr. 368. 1860. Nom. subs., *C. × intermedia* Ehrh. in syn.

*Circaea ericetorum* Martrin-Donos, Bull. Soc. Bot. France 9: 130. 1862. TYPE: France, Dept. Tarn, Valence, among the heath ("Parmi les Bruyers").

*Circaea × intermedia* Ehrh. var. *minor* Grognot, Carian Cat. Pl. Saone-et-Loire 154. 1863.

*Circaea lutetiana* L. var. *intermedia* (Ehrh.) H. Lév., Monde des Pl. 7: 71. 1898.

*Circaea lutetiana* L. subsp. *intermedia* (Ehrh.) Rouy & Camus, Fl. Fr. 7: 204. 1901.

*Circaea lutetiana* L. subsp. *intermedia* (Ehrh.) Rouy & Camus β *ericetorum* (Martrin-Donos) Rouy & Camus, Fl. Fr. 7: 205. 1901.

*Circaea lutetiana* L. subsp. *intermedia* (Ehrh.) Rouy & Camus γ *minor* (Grognot) Rouy & Camus, Fl. Fr. 7: 205. 1901.

*Circaea lutetiana* L. race *intermedia* (Ehrh.) H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 219. 1912.

*Circaea lutetiana* L. race *intermedia* (Ehrh.) H. Lév. forma *ericetorum* (Martrin-Donos) H. Lév., Bull. Acad. Int. Géogr. Bot. 22: 219. 1912.

*Circaea canadensis* (L.) Hill, sensu Fern., Rhodora 19: 85–88. 1917.

*Circaea × intermedia* Ehrh. forma *major* H. Lév. ex Hegi, Ill. Fl. Mit.-Eur. 5: 880. 1925.

*Circaea × intermedia* Ehrh. forma *minor* (Grognot) Hegi, Ill. Fl. Mit.-Eur. 5: 880. 1925.

*Circaea × intermedia* Ehrh. forma *bracteolata* H. Lév. ex Hegi, Ill. Fl. Mitt-Eur. 5: 880. 1925.

*Circaea × canadensis* (L.) Hill, sensu Fern. var. *rishiriensis* Hara, J. Jap. Bot. 34: 317. 1959. TYPE: Japan, Hokkaido, Rishiri Island, Oshidomari, August 1903, T. Makino (MAK 6954, holotype; TI, isotype).

Erect or decumbent at the base and rooting at the nodes, 0.7–4(–7) dm tall, simple or more commonly, branched above, very rarely bushy branched from near the base. Plants forming numerous and vigorous rhizomes, these occasionally giving rise late in the season to tuberous thickenings at the apex but most commonly the apical portion only slightly dilated; rhizomes also occasionally arising from the lowermost nodes of the stem and then arching and ultimately

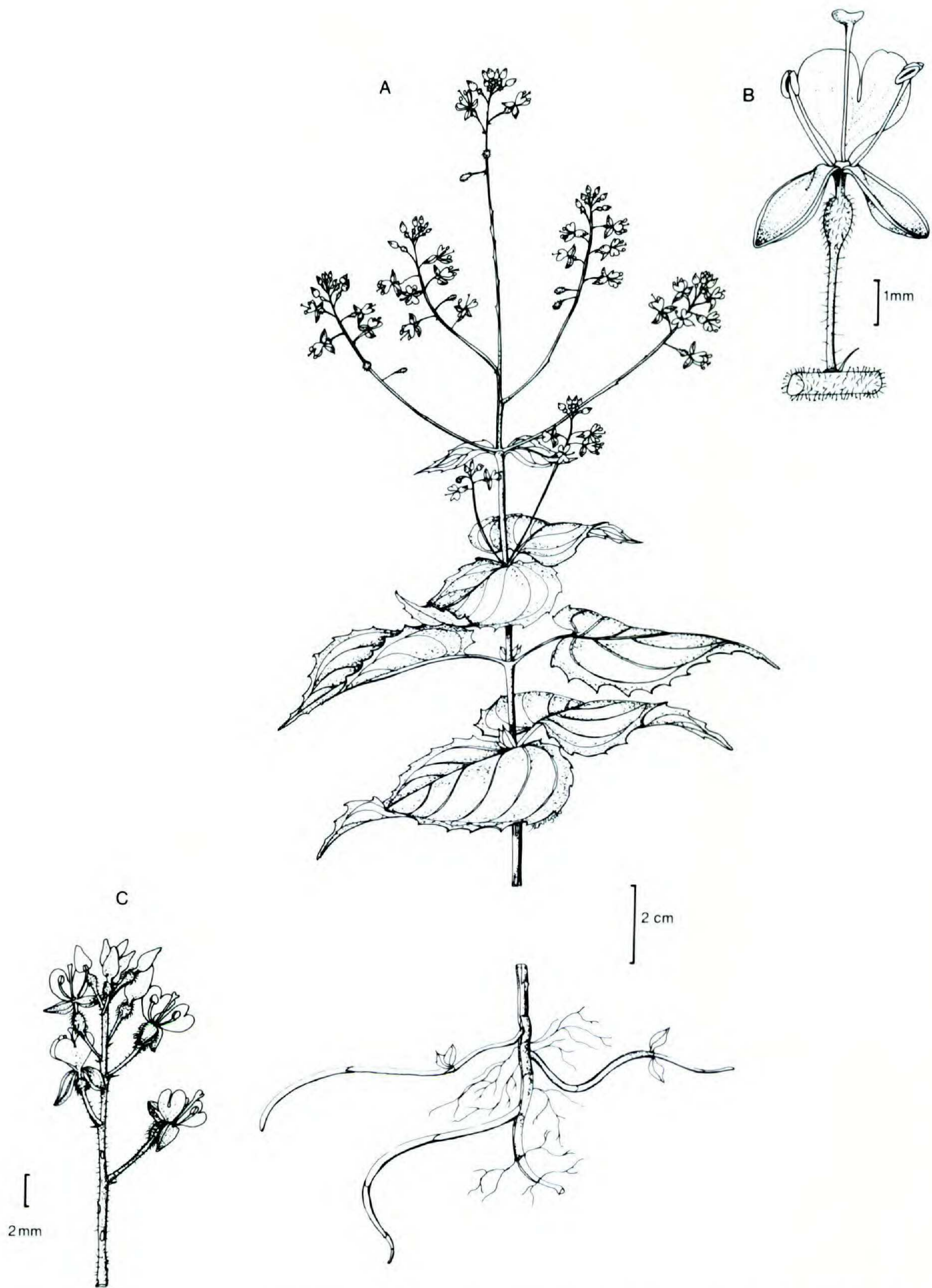


FIGURE 32. *Circaea* × *intermedia* Ehrh. (*C. alpina* L. subsp. *alpina* × *C. lutetiana* L. subsp. *canadensis* (L.) Asch. & Magnus).—A. Upper portion of flowering stem, roots—B. Flower with petal removed; note exserted nectary.—C. Inflorescence. From Boufford 18829 (MO).

becoming subterranean, often the above ground portion giving rise to upright shoots from the nodes during the current growing season and often with the scalelike leaves enlarged and similar to the stem leaves; all rhizomes ultimately subterranean and giving rise to the following year's plants from their tips. Stem

glabrous or occasionally the nodes with a few soft, short, falcately recurved hairs, 0.2–0.3 mm long, less commonly the stem densely pubescent above with similar hairs. Axis of the inflorescence sparsely to densely pubescent with soft, short, capitate and clavate tipped glandular hairs. Petioles sparsely to densely pubescent in lines above with soft, short, upwardly curved, falcate hairs, these often continuing along the veins on the upper surface of the blade, and sometimes also on the interveinal areas, at least near the base, the leaf margins with slightly curved to falcate cilia. Stem green, commonly the nodes purple. Leaves horizontally spreading, drooping at the tips, pale to deep green but most commonly blotchy with irregular patches of pale and dark green, semi-translucent to opaque. Leaves from just above the middle to the summit of the stem the largest, 2–7(–11) cm long, 1.3–4.2(–7) cm wide, abruptly to gradually reduced in size upward to the base of the inflorescence and eventually bractlike and alternate, gradually to abruptly reduced in size downward; distantly to closely spaced, narrowly to broadly ovate, abruptly to gradually short acuminate to acute at the apex, rounded to cordate at the base, denticulate to prominently serrate. Petioles 0.8–5.5 cm long, terete or semiterete, sometimes flattened in pressing and appearing winged; pubescent in lines above with soft, short, upwardly curved, falcate hairs, 0.2–0.3 mm long; most often with reduced branches arising in the axils. Inflorescence sparsely to densely pubescent, with soft, short, capitate and clavate tipped, glandular hairs, 0.2–0.3 mm long; terminal on the main stem and a simple raceme or, more commonly, with one or more lateral branches arising from the base of the terminal raceme and from the tips of the short, uppermost axillary branches, less commonly at the tips of reduced branches arising from the lower axils; the lateral branches alternate or occasionally opposite, subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, ca. 1.5 cm long at initiation of flowering, to 18 cm long at cessation of flowering; the lateral racemes 1.5–3 cm long at initiation of flowering, to ca. 15 cm long at cessation of flowering, these equal or unequal in length on the same plant. Flowering pedicels 1.8–5.5 mm long, ascending at ca. a 45° angle to perpendicular to the axis of the raceme, glabrous to pubescent, with soft, short, capitate and clavate-tipped glandular hairs ca. 0.1 mm long; with a minute setaceous bracteole, 0.1–0.8 mm long, at the base. Fruiting pedicels developing to ca. 8 mm long before abortion of the fruits. Buds glabrous or, rarely, minutely and sparsely pubescent, with short glandular hairs ca. 0.1 mm long; white, pink or very pale green, commonly purple tinged at the apex; elliptic, oblong, oblong ovate to broadly obovate in outline, gradually tapering or short acuminate to the obtuse or minutely mammiform apex; from the summit of the ovary, 2–4.2 mm long, (0.7–)1–2.2 mm thick just prior to anthesis. Ovary 0.7–1.7 mm long, 0.5–1.1 mm thick at anthesis, fusiform, broadly ellipsoid to clavate or obovoid, densely covered with soft, short, translucent, uncinuate hairs. Floral tube 0.4–1.2 mm long, 0.2–0.3 mm thick at the narrowest point, funnelform to very narrowly so, often the sides concavely tapering. Sepals 1.6–3.5 mm long, 0.9–2 mm wide, glabrous or glabrescent on the abaxial surface with hairs as on the buds, white, pink or pale green, commonly purple tinged at the apex, rarely purple throughout; narrowly oblong to oblong ovate or ovate, rounded to short acuminate to the obtuse or minutely mammiform apex; divergent to reflexed at anthesis. Petals

(1-)1.6-3.6 mm long, (0.6-)1.5-3.6 mm wide, longer than wide to as wide as long, white or pink, narrowly obtriangular to very broadly obovate in outline, cuneate to rounded at the base; the apical notch (0.4-)0.7-2.1 mm deep, ( $\frac{1}{3}$ -) $\frac{1}{2}$ - $\frac{3}{4}$  the length of the petal, the petal lobes rounded at the apex. Stamens erect or ascending, less commonly spreading at anthesis, as long as or slightly shorter than the style; filaments 1.3-3.7 mm long; anthers 0.4-0.7 mm long, 0.3-0.6 mm thick. Style straight, erect, 2.7-4.7 mm long; topped by an obtriangular to transversely oblong, often very prominently bilobed, stigma, 0.2-0.7 mm tall, 0.2-1.2 mm thick. Nectar secreting disc present as a low ring or cylindrical disc above the opening of the floral tube, 0.1-0.4 mm tall, 0.4-0.7 mm thick. Fruit sterile and aborting before maturity but occasionally developing to ca. 3 mm long and ca. 1.5 mm thick, clavate to obovoid, bilocular, often with one locule larger than the other, both containing infertile seeds; densely covered with stiff, translucent, uncinuate hairs. Immature fruiting pedicels spreading perpendicular to the raceme axis or slightly reflexed. Combined length of pedicel and immature, sterile fruit developing to ca. 7.3 mm long. Gametic chromosome number,  $n = 11$  (9 bivalents plus a ring or chain of 4 or 11 bivalents at meiosis).

TYPE: Germany, Diester Gebirge ("in Monte Diester"), *Ehrhart 101* (GOET, lectotype; L, W, isolectotypes).

Distribution (Figs. 33, 34): Moist places in deciduous, mixed or coniferous forests, especially in naturally disturbed areas along streams, occasionally as a weed in hedgerows and gardens in Europe. Central and western Europe, north to southern Scandinavia, southeast to E. Germany, Poland, Czechoslovakia, Austria, and Italy, west to southwestern France; British Isles; Caucasus Mountains; sporadically across Siberia to Far Eastern Asia; northeastern United States and southeastern Canada, westward to western Ontario, Minnesota, and Wisconsin; scattered in the Appalachian Mountains to North Carolina; disjunct in southwestern South Dakota. From sea level to ca. 1,800 m. Flowering, late June to late August.

#### Representative specimens examined:

##### NORTH AMERICA

CANADA. NEW BRUNSWICK: York Co., 1 mi. W of Keswick, *B. Boivin et al. 13337* (DAO, MT, TRT, UNB); Carleton Co., 2.5 mi. E of Hartland, *G. C. Cunningham in 1960* (DAO); Carleton Co., W of Woodstock, *W. Dore & E. Graham 45911* (ACAD, DAL, DAO, LL, MT, NHA); York Co., Upper Queensbury, St. John R., *M. L. Fernald & A. S. Pease 25204* (CAN, GH, MT, NY, US); Bass River (Nova Scotia?), *J. Fowler in 1875* (NY, US, WIS); Victoria Co., Salmon R., *G. A. Inch in 1892* (UNB); York Co., Crock's Point, St. John R., *P. R. Roberts 59-858* (UNB); Carleton Co., Hartland, *P. R. Roberts 60-256* (CAN); Victoria Co., Tobique R. at Arthurette, *P. R. Roberts & D. Drury 63-1212* (ACAD, UNB); Westmoreland Co., rte 30 W of Horewood, *P. R. Roberts & N. Bateman 64-2336* (ACAD, DAO, UNB); Kent Co., NNW of St. Anthony, Little Buctouche R., *P. R. Roberts & N. Bateman 64-2930* (UNB); Victoria Co., Tobique R. valley at Oxbow, *P. R. Roberts & B. Pugh 65-1123* (CAN, UNB); Kent Co., 1.5 mi. S of S St. Nicholas, W of St. Nicholas Bridge, *P. R. Roberts & B. Pugh 65-2304* (CAN, MT, UNB); Northumberland Co., 24 mi. W of Blackville, *P. R. Roberts & B. Pugh 65-3716* (CAN, UNB); Restigouche Co., mouth of Big Hole Brook at Jacquet R., *P. R. Roberts & B. Pugh 65-4833* (UNB); Kings Co., 1 mi. E of Rockville, *P. R. Roberts & B. Pugh 65-6454* (UNB); Kings Co., Sussex, *H. J. Scoggan 12354* (ACAD, CAN, MAK, W); York Co., Keswick, *E. Smith 19302* (ACAD); Carleton Co., 2 mi. SE of Hartland, *E. Smith & R. Clattenbug 20005* (ACAD); Albert Co., Pleasant Vale, *E. Smith et al. 20935* (ACAD); Carleton Co., Woodstock, *G. Stirrett in 1942* (DAO). NOVA SCOTIA: Kings Co., Kentville, *H. P. Bell 218* (DAL); Inverness Co.,

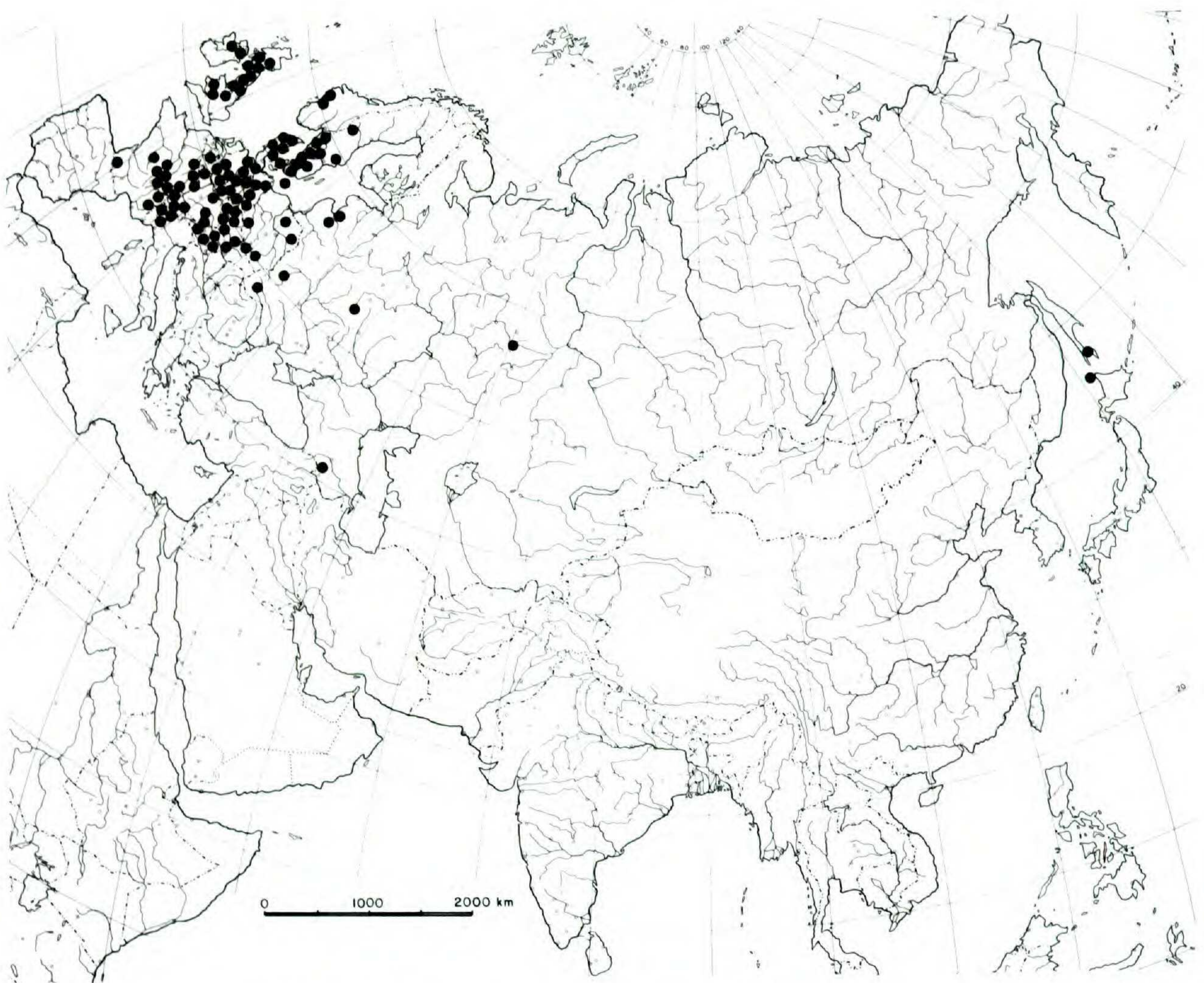


FIGURE 33. Distribution of *Circaea* × *intermedia* Ehrh. (*C. alpina* L. × *C. lutetiana* L.) In Eurasia.

Cape Breton Island National Park, 4 mi. E of Pleasant Bay, W. Cody 21482 (DAO); Queens Co., Charleston, J. Donly 1262 (ACAD); Pictou Co., Union Centre, W. Dore & E. Gorham 45437 (ACAD, DAL, DAO, MT); Colchester Co., Great Village, J. S. Erskine 51133 (ACAD, DAO, MT); Hants Co., bank of Meander R., J. S. Erskine 52776 (ACAD, CAN); Hants Co., Five Mile River, J. S. & D. Erskine 55529 (ACAD); Pictou Co., Salt Springs, J. S. Erskine 55792 (CAN); Halifax Co., Upper Musquadoit, J. S. Erskine 51766 (ACAD, MT); Pictou Co., E of St. Mary, J. S. Erskine 551154 (ACAD); Kings Co., Kentville, M. L. Fernald in 1902 (GH), H. Groh in 1930 (DAO); Pictou Co., Mt. Thom along rte 104, M. J. Harvey in 1978 (DAL); Colchester Co., Stewiacke, along St. Andrews R., M. J. Harvey in 1978 (DAL); Cumberland Co., Wentworth, Wallace R., J. W. McLellan in 1938 (DAO); Kings Co., Kentville, J. W. McLellan in 1938 (DAO, NA); Kings Co., Kentville, Farm Ravine, H. Newcombe 11480 (ACAD); Cape Breton Island, G. Nichols 732 (GH); Five Mile River, A. S. Pease & B. Long 22004 (CAN, GH, PH); Hants Co., Five Mile River, A. R. Prince & C. E. Atwood 1102 (DAO, DS, GH, MICH, WIS); Colchester Co., Truro, Salmon R., A. R. Prince & C. E. Atwood 1410 (CAN); Cumberland Co., Centre Wentworth, A. E. Roland 40580 (TRT); Inverness Co., Cape Breton, Cape North, E. Scammon 4382 (GH); Cumberland Co., Wentworth, Wallace R., W. Schofield 5271 (ACAD); Guysborough Co., Glenelg, E. C. Smith et al. 527 (ACAD); Guysborough Co., N of Intervale, Guysborough R., E. C. Smith et al. 659 (ACAD, DAO); Inverness Co., Hillsborough, E. C. Smith et al. 999 (DAO); Victoria Co., Intervale forest, N Aspy R. Bridge, E. C. Smith et al. 2703 (ACAD); Inverness Co., Judique, E. C. Smith et al. 3956 (ACAD, DAO); Inverness Co., Melford, E. C. Smith et al. 8728 (ACAD, CAN, MT, TRT); Pictou Co., West River, E. C. Smith et al. 9871 (ACAD, MT, TRT); Antigonish Co., Crystal Cliffs, E. C. Smith et al. 11563 (ACAD, TRT); Victoria Co., North River Bridge, E. C. Smith et al. 14923 (ACAD, CAN, DAO); Antigonish Co., 2 mi. E of Purl Brook, E. C. Smith et al. 17867 (ACAD); Queens Co., Mill Village, E. C. Smith et al. 21278 (ACAD); Hants Co., Five Mile River near Latties Brook, E. C. Smith et al. 21891 (DAO, UNB); Colchester Co., Kempton, E. C. Smith et al. 23546 (DAO). ONTARIO: Ontario Co., Whitby,

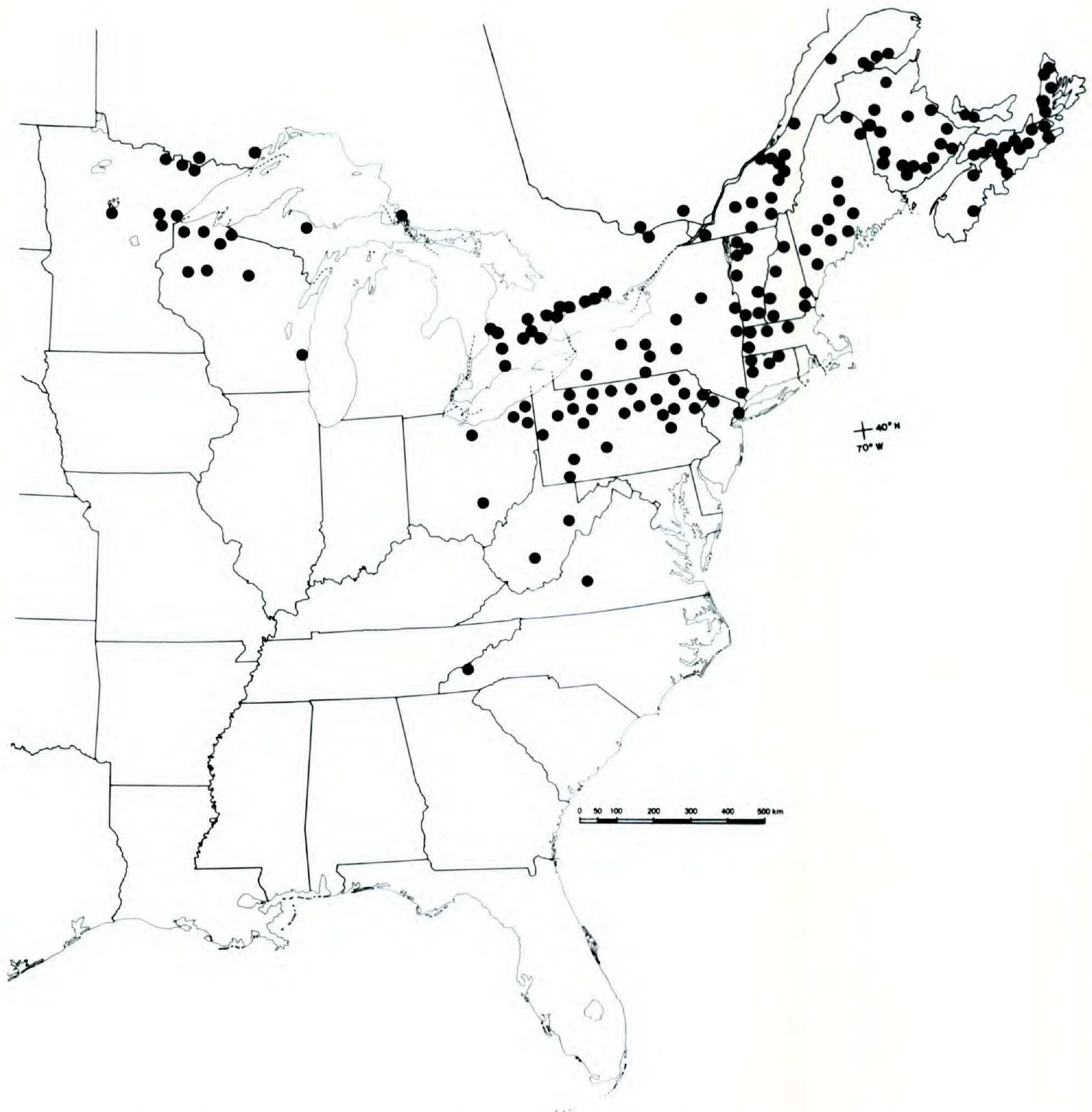


FIGURE 34. Distribution of *Circaea*  $\times$  *intermedia* Ehrh. (*C. alpina* L.  $\times$  *C. lutetiana* L.) in North America.

*L. V. Baker* in 1915 (TRT); Ontario Co., Hamilton, *T. Burgess* in 1888 (MTMG); Ottawa Dist., *M. Canfield* in 1966 (KYO); Thunder Bay Dist., Crooks Twp, *Cormack & Mayall* in 1936 (TRT); York Co., Toronto, Victoria College Grounds, *J. E. Cruise* 78 (TRT); Thunder Bay Dist., Crooks Twp, Pine R., *C. E. Garton* 2175 (CAS, DAO, GH, H, MIN, NY, RM, TRT, UC, US, W, WIN); Hastings Co., Marmora Twp, 3.5 mi. NE of Marmora, *J. Gillett* 6485 (DAO); York Co., 2 mi. NW of Nobleton, 2 mi. E of Bolton, *E. Haber* 553 (CAN, DAO, MICH, MTMG, NCU, TRT); Ontario Co., Swiss Chalet Park, N side of hwy 7 at Greenwood Pickering Twp, *E. Haber* 558 (CAN, DAO, MTMG, NCU, TRT); Ontario Co., Pickering Twp, ca. 1 mi. N of Greenwood, *E. Haber* 561 (CAN, DAO, MTMG, NCU, TRT); Peel Co., near Bolton, Cold Creek Swamp, *J. M. Hamley* in 1959 (TRT); Waterloo Co., German Mills, *E. James* 26439 (DAO, NA, TRT); Huron Co., 2 mi. NE of Bayfield, *P. Maycock & O. Maryniak* 2842 (MTMG); Huron Co., Colborne Twp, 6 mi. N of Goderich, *W. Minshall* 4764 (DAO); Algoma Dist., 10 mi. W of Sault Ste. Marie, *D. Ropke* 531 (DAO); Wellington Co., Elora, Elora Gorge Conservation Area, *W. Stewart* 1073 (DAO); Elgin Co., Union, *G. Stirrett* in 1934 (DAO); Middlesex Co., Biddulph Twp, Lucan, *G. R. Thaler* 286 (TRT); Huron Co., boundary Goderich-Stanley Twps, Varna, *G. R. Thaler* 452 (TRT); NE Toronto, Dollar, *S. L. Thompson* 290 (TRT); Waterloo Co., New Hamburg, *L. M. Umbach* in 1899 (MIN); Waterloo Co., New Hamburg,

*W. Umbach in 1894* (WIS); Rainy River Dist., Quetico Park, Three Mile Lake, *S. Walsh & D. Haddow 75-196* (CAN); Northumberland Co., Cobourg, *J. Young in 1919* (CU). PRINCE EDWARD ISLAND: Prince Co., Lower Freetown, *D. Erskine in 1967* (DAO); Prince Co., Seales Pond, *D. Erskine in 1975* (DAO). QUEBEC: Rimouski Co., Bic, *E. Bartram & B. Long 393* (PH); Huntington Co., 1.25 mi. SE of Franklin Center, *I. Bassett & A. Hamel 2581* (DAO); Megantic Co., Leeds Twp, at Osgoode R. bridge, *J. A. Bailey 1623* (V, mixed sheet with *C. lutetiana* subsp. *canadensis*); Matapedia Co., Matapedia, *R. Barabe in 1940* (DAO); Bonaventure Co., Cascapedia, Cascapedia R., *R. & J. Cayouette 6350* (DAO); Gibraltar, Lake Memphremagog, *J. Churchill in 1902* (GH); Bonaventure Co., Nouvelle, Nouvelle R., *J. Collins & M. L. Fernald in 1904* (CAN, GH, MIN, MT); Harrington, *F. Cutten, in 1968* (MTMG); Richmond Co., Drummondville, *Fr. Euplius 525* (MT); Gatineau Park, near Luskville, *J. Gillett & G. Savage 15861* (CAN); Wolfe Co., Lingwick, Saumon R., *C. Hamel & S. Brisson 15407* (CAN, DAO, MTMG, SASK); Levis Co., Levis, Rang Sorosto, *C. Leduc L67-302* (TRT); Bonaventure Co., Nouvelle R., *E. Lapage 13427* (DAO); Compton Co., 0.5 mi E of Cookshire, *P. Maycock et al. 12793* (MTMG); Ancienne Lorette, near Petite R., *Fr. Marie-Victorin 15899* (CAN, GH, MT); Ancienne Lorette, Ruisseau d'Eau Claire, *Fr. Marie-Victorin 28417* (ACAD, CAN, DAO, GH, MT); Montmagny Co., Grosse-Ile, *Fr. Marie-Victorin 40019* (CAN, GH, IA, MT, NY); Montmorency Co., Montmorency, *Fr. Marie-Victorin et al. 44006* (CU, DAO, GH, MT, ND, TRT, UC); Bellechasse Co., Beaumont, *P. Masson 7624* (H); junction of Restigouche & Matapedia Roads, *J. Rousseau 32245* (CAN, DAO, MT, NY); Matapedia, Matapedia R., *J. Rousseau 32436* (CAN, DAO, GH, H, MT); mouth of Matapedia R., *H. Scoggan 908* (CAN); Sainte-Marie, *F. Stanislaus 566* (MT); Richmond Co., Ilverton, off Black R., *L. Terrill 7411* (DAO); Rimouski Co., Bic, Petite Portage, *C. Williamson in 1910* (PENN, PH).

UNITED STATES. CONNECTICUT: HARTFORD COUNTY, Bloomfield, along Farmington R., *C. A. Weatherby 4990* (NCSC, NEBC, PH); LITCHFIELD COUNTY, Kent, Falls Brook, *C. H. Bissell in 1921* (BHO), 1.2 mi E of rte 7 on rte 4, E of Cornwall Bridge, *D. E. Boufford & H. E. Ahles 18840* (MO), Cornwall, Cathedral R., *E. Hager 7317* (NEBC), Kent, *C. A. Weatherby 4950* (GH, NEBC); TOLLAND COUNTY, Union, *C. A. Weatherby 4772* (CAS, GH, NCSC, NEBC). MAINE: ARROSTOOK COUNTY, Fort Fairfield, Aroostook R. basin, *G. D. Chamberlain 2024* (UC), Fort Kent, St. John R., *E. Williams in 1900* (GH); CUMBERLAND COUNTY, Brunswick, *K. Furbish in 1891* (NEBC); FRANKLIN COUNTY, Farmington, *C. H. Knowlton in 1909* (NCSC, NEBC, NHA, WIS), *C. H. Knowlton in 1915* (PH, POM), Strong, *C. H. Knowlton in 1917* (PH); KENNEBEC COUNTY, Sidney, *M. L. Fernald & B. Long 14210* (GH, NEBC, NY, PH), Windsor, *M. L. Fernald 2628* (NEBC), Farmingdale, *C. H. Knowlton in 1917* (NCU, NEBC, PH) Winslow, *A. Norton 8840* (NHA); OXFORD COUNTY, Gilead, *A. S. Pease 17810* (NEBC); PENOBSBOT COUNTY, Pushaw Lake, *K. Furbish in 1891* (NEBC); PISCATAQUIS COUNTY, near Hunt's (near Katahdin), *A. Chute in 1847* (GH), Foxcroft, *M. L. Fernald 293* (CAN, GH, MASS, MIN, NEBC, NHA, NY, PH, US, WIS), trail to Hagas Gulf at Hay Brook, *F. C. Seymour 27910* (VT); SOMERSET COUNTY, Fairfield, *M. L. Fernald & B. Long 14209* (GH, NEBC, NY, PH), S of Benham, Kennebec R., *W. E. Manning in 1934* (NEBC); WALDO COUNTY, Frankfort, *M. L. Fernald & B. Long 14208* (GH, ILL, NEBC, PH), Unity, *F. C. Seymour 30059* (VDB). MASSACHUSETTS: BERKSHIRE COUNTY, Sandisfield, ravine at Campbell Falls, *E. Hager 7948* (NEBC), Mt. Washington, Bash Bish Brook, *R. Hoffmann in 1914* (NEBC), Sheffield, *R. Hoffmann in 1920* (NEBC); Bash Bish Falls, *F. Walters in 1913* (NHA); FRANKLIN COUNTY, base of Whately Glen, *W. E. Manning in 1930* (GH); WORCESTER COUNTY, New Braintree, Worcester, *B. Gates 31851* (NEBC, US). MICHIGAN: MARQUETTE COUNTY, Turin, *B. Barlow in 1901* (GH, NY, US). MINNESOTA: CARLTON COUNTY, Jay Cook Park, S of the St. Louis R., *O. Lakela 3746* (DAO, DUL, GH, MIN, TENN); CASS COUNTY, Lake Kilpatrik, *C. Macmillan & E. Sheldon 44* (ORE); LAKE COUNTY, outlet to Basswood Lake from Wind Lake, *O. Lakela et al. 16499* (DUL); ST. LOUIS COUNTY, S33, T49N, R15W, Magney Park, *E. Flaccus 10* (DUL), Duluth, below Superior Street bridge, *O. Lakela 1277* (DUL, MIN, NY, US), Fond du Lac, Mission Creek Valley, *O. Lakela 4195* (MIN), Duluth, Hunter's Hill, Tischer Creek bank, *O. Lakela 7847* (DUL), Crane Lake, Congdon Resort, *O. Lakela 13788* (DUL). NEW HAMPSHIRE: CHESHIRE COUNTY, Walpole, 3 mi. S of the junction of rtes 12 & 123 on 12, *D. E. Boufford 18851* (BM, C, CAS, CM, E, G, GH, K, KYO, LD, LE, MASS, MHA, MICH, MO, NHA, NCU, NY, P, PE, S, SHIN, UC), Alstead, *H. Noyes & M. L. Fernald 366* (GH, NEBC, NY); COOS COUNTY, Lancaster, *A. S. Pease 12827* (NEBC); GRAFTON COUNTY, above Plymouth, *M. L. Fernald 11819* (GH, NEBC); ROCKINGHAM COUNTY, Nottingham, Pawtuckaway Reservation, *A. R. Hodgdon & F. Steele 10742* (NHA); STRAFFORD COUNTY, Farmington, *C. W. T. W. in 1902* (NHA); SULLIVAN COUNTY, Plainfield, Sumner's Falls, *D. E. Boufford 4356* (KESC). NEW JERSEY: SUSSEX COUNTY, Montague Twp, *G. Nash in 1909* (NY). NEW YORK: CATTARAUGUS COUNTY, along Quaker Run, *W. Alexander & H. D. House 12332* (NYS); CAYUGA COUNTY, Genoa, Salmon Creek, *A. Eames 10508* (CU, IND); CHEMUNG COUNTY, Millport, bottom of Johnson Hollow ravine, *S. Smith 1439* (CU); CHENANGO COUNTY, Norwich, *M. H. Fitch s.n.* (POM); HAMILTON COUNTY, SE Benson Twp, Cole Hill, *E. Brundage et al. 4661* (NYS); NEW YORK COUNTY, Harlem Valley, *W. C. Twiss in 1918* (UT);

ONEIDA COUNTY, S of Utica, *J. Haberer 320d* (NYS); ONTARIO COUNTY, Canandaigua Lake, *Mrs. L. Ward in 1881* (US); RENSSELAER COUNTY, 3 mi. N of Nassau, *H. D. House 21767* (NYS); TOMPKINS COUNTY, Enfield, below Lucifer Falls, Enfield Ravine, *E. Dean & E. Eames 4636* (CU, GH), Ulysses, Taughannock Ravine, *A. Eames 8520* (CU, GH, IND, MICH, NYS), Ithaca, Enfield Gorge, *W. C. Muenscher & A. R. Bechtel 615* (CU, ISC, WS); WASHINGTON COUNTY, 2 mi. E of Vaughns, N of Hudson Falls, *S. H. Burnham in 1916* (BH, GH); WESTCHESTER COUNTY, Bedford, *N. L. Britton in 1900* (CM, RM). NORTH CAROLINA: SWAIN COUNTY, Cherokee Reservation, Qualla, *J. Mooney in 1888* (NCSC, US). OHIO: ASHTABULA COUNTY, Windsor Twp, 0.5 mi. S, U.S. rte 322, *L. W. Tandy 827* (VDB); GEauga COUNTY, Bainbridge Twp, *W. D. Hawver 1123* (KE); HOCKING COUNTY, Ash Cove, *E. A. Albaugh & L. Stephenson in 1930* (OS); HURON COUNTY, Collinswood, *S. Baldwin in 1888* (GH); TRUMBULL COUNTY, Casey's Spring, along Mill Creek, *D. E. Boufford 18822* (MO), above Mill Creek at Casey's Springs area, 2 mi. NNW of Mesopotamia, *T. S. Cooperrider 7924* (KE). PENNSYLVANIA: BLAIR COUNTY, 5.2 mi. N of Tipton, *W. E. Buker in 1972* (CM); CLINTON COUNTY, Lamar Twp, 3.6 mi. N of rte I-80 on rte 477, *D. E. Boufford 18831* (CM, KYO, MASS, MHA, MO), 2.5 mi. S of Raughtown, along Antes Run, *W. F. Westerfeld 5175* (PAC, WIN); COLUMBIA COUNTY, 0.25 mi. NW of Central, *F. Fosberg 15985* (PENN); ELK COUNTY, Meddix Run, *O. E. Jennings & McClelland in 1925* (CM), Benezette Twp, *A. Rood & W. Simon 451* (PAC, PENN); FAYETTE COUNTY, Laurel Ridge at Ohiopyle, *J. Bright 9715* (SMU), *9716* (MIN), *9718* (DS), 1 mi. N of W. Va. line, Wymps Gap, Laurel Run, *O. E. Jennings & Lewis in 1940* (CM), 4 mi. SW of Ohiopyle, *O. E. Jennings in 1941* (CM), halfway between Ohiopyle & Dunbar, *O. E. Jennings in 1941* (CM); FOREST COUNTY, 1 mi. SE of Neiltown, *A. Shields D1957* (PAC); JEFFERSON COUNTY town of Sigel, 4.7 mi. SW of the junction of rtes 36 & 949 on 949, *D. E. Boufford 18825* (CM, KYO, MHA, MO), S of Allen Mills, 3.6 mi. N of rte I-80 on rte 310, *D. E. Boufford 18829* (BM, C, CM, E, G, GH, K, KYO, LD, MASS, MHA, MO, NCU, NY, PE, SHIN), along Mill Creek at rte 949, 5 mi. SW of Sigel, *L. K. Henry in 1952* (CM), 2.5 mi. S of Allens Mills, *L. K. Henry in 1953* (CM), along Clarion R. at Cooksburg, *O. E. Jennings in 1936* (CM); LACKAWANNA COUNTY, 1.5 mi. NNW of Dalton, *S. Glowenke 8869* (GH, PAC, PENN); LAWRENCE COUNTY, Rock Point, *O. E. Jennings in 1909* (CM), on the Connequenessing near Ellwood, *J. A. Shafer in 1900* (CM, PH), Chewton to Wurtemberg, *J. A. Shafer in 1900* (CM); LUZERNE COUNTY, North Mt. above Ricket's, *H. Meredith in 1920* (PENN); LYCOMING COUNTY, at Barbours, *H. A. Wahl 13565* (PAC, PENN), Pine Creek, 1.75 mi. ENE of Cedar Run, *H. A. Wahl 17690* (CU, GH, ISC, NCU, PAC, PENN), Little Pine Creek at English Center, *C. Wood, Jr. 1539a* (PENN); MCKEAN COUNTY, 1 mi. WNW of Eldred, *J. Fogg et al. 19831* (PENN), 1.25 mi. N of Derrick City, *J. Fogg et al. 19877* (PENN), Mt. Jewett, *O. E. Jennings in 1922* (CM); MONROE COUNTY, just W of Canadensis, *I. Langman 1118* (PENN); PIKE COUNTY, 2.5 mi. NE of Milford, *P. DePue 447* (BH, PENN); POTTER COUNTY, 4 mi. S of Coudersport, *C. E. Shaw in 1958* (CM), 2 mi. NW of Walton, *C. Wood, Jr. 1719* (PENN); SCHUYLKILL COUNTY, Neuremberg, valley of Big Tomchicken Creek, *A. E. Ortmann in 1909* (CM); SULLIVAN COUNTY, North Mountain, *D. Meredith in 1920* (PH); SUSQUEHANA COUNTY, Susquehanna, Conowacta Creek, *S. Glowenke 9880* (NYS, PENN), Camp Susquehannock near Montrose, *L. Sowden in 1927* (PH), Elk Knob, 3 mi. N of Elkdale, *H. Wilkens 4794* (PAC); TIOGA COUNTY, Stony Fork Creek, *F. Trembley 181* (PENN); VENANGO COUNTY, 2.5 mi. S of Cranberry, *L. K. Henry in 1954* (CM); WARREN COUNTY, Allegheny National Forest S of Warren, *A. L. & H. N. Moldenke 27333* (LL); WESTMORELAND COUNTY, Powdermill Nature Reserved, Calverly area, *L. K. Henry in 1957* (CM). SOUTH DAKOTA: PENNINGTON COUNTY, Grizzly Bear Creek near Keystone, *H. E. Lee 480* (SDU), Grizzly Bear Creek, *H. E. Lee 499* (RM). VERMONT: ADDISON COUNTY, Ripton, Moosalamo Mt., *E. Brainerd in 1903* (VT), Salisbury, *E. Brainerd in 1903* (VT), *W. W. Eggleston 3281* (CM, DS, GH, NY, VT), Lake Dunmore, *T. Hope in 1917* (NEBC); BENNINGTON COUNTY, Manchester, *M. Day 363* (GH, NEBC, US, VT); CHITTENDEN COUNTY, *without collector in 1896* (VT); FRANKLIN COUNTY, Swanton, *C. H. Knowlton in 1931* (IND, NEBC), *C. H. Knowlton in 1932, Pl. Exs. Grayanae 571* (BH, BHO, CAS, COLO, CU, DAO, DS, DUKE, GA, GH, IA, ILL, ISC, KANU, LL, MASS, MICH, MIN, MONTU, MT, NA, NCSC, NCU, NEBC, NHA, NO, NY, NYS, PAC, PENN, PH, POM, RM, SMU, TENN, TEX, TRT, UARK, UC, UMO, US, UTC, WIS, WS, WTU, WVA. Specimens distributed as this collection at CAN & VT are *C. lutetiana* subsp. *canadensis*); LAMOILLE COUNTY, Morristown, *C. H. Knowlton in 1917* (ASU, NEBC, PH); WINDHAM COUNTY, Guilford, *S. K. Harris 23244* (NEBC), Townsend, *L. Wheeler in 1922* (NEBC); WINDSOR COUNTY, Royalton, *W. W. Eggleston 2573* (ILL, MIN, NY). VIRGINIA: BEDFORD COUNTY, Hales Fork, ca. 1 mi. below Camp Kewanee, Apple Orchard Mt., *R. S. Freer in 1933* (LYN), WEST VIRGINIA: FAYETTE COUNTY, near Thayer, *W. M. Grafton & C. McGraw in 1967* (WVA); RANDOLPH COUNTY, along Gandy Creek S of Whitmer at Swallow Rock, *R. B. Clarkson 3115* (WVA), mouth of Glade Run, Shavers Fork, *R. & J. Findley 158* (MAK), mouth of Whitmeadow Run, Shavers Fork, *R. & J. Findley 176* (CLEMS), Cheatbridge, *E. M. McNeill in 1948* (WVA), Winchester, Cheat R. clearings, *C. F. Millspaugh 737* (NY, WVA). WISCONSIN: ASHLAND COUNTY, S of Ashland, White R., *L. Cheney 4722* (WIS); BARRON COUNTY, Barron, *C. Goessl 8634* (B); BAYFIELD COUNTY, Fish Creek valley, *N. Bobb 770* (WIS); DOUGLAS



COUNTY, near St. Louis R. opposite Fond du Lac, *L. Cheney* 7906 (WIS); IRON COUNTY, Ash Woods, Kimball Rd., *L. J. Uttal* 12529 (VPI); LINCOLN COUNTY, Corning Twp, T31N, R5E, S17, *F. C. Seymour* 15488 (SMU, WIS); OZAUKEE COUNTY, 1.6 km SE of Lake Church, along Lake Michigan, *H. H. Iltis* 20301 (KYO); RUSK COUNTY, N of Strickland, Stony Brook, *N. C. Fassett* 22044 (WIS).

## EUROPE

AUSTRIA. S Tyrol, Gavardina Mts., *J. Ball* in 1860 (IA); Gmunden, *S. Dörfler* in 1887 (UC); Steiermark, Fedbach, Karbachtal, *H. Fleischmann s.n.* (W); at Durrbach near Ansdorf on Donan, *P. Fürst* in 1903 (W); Burgstein, *P. Fürst* in 1904 (W); near Adamstal near Brünn, *C. Hochstetter s.n.* (NA); Voralberg, Jagdberg near Schlins, *A. Neumann* in 1967 (W); North Tirol, Oberes Inntal, Kronburg near Zams, *A. Polatschek* in 1967 (W); N Tirol, Kössener Achenal, between Kössen & Klobenstein, *A. Polatschek* in 1972 (W); N Tirol, Oberintal, Schönwies, *A. Polatschek* in 1972 (W); Steiermark, pagum Aussee, *K. & L. Rechinger* 645 (DS, H, ND, W); Styria, Aussee, *K. Rechinger* in 1928 (MO); Voralberg, Wolfurt near Bregenz, *R. Seipka* in 1971 (W); Hallstatt, *O. Stapf, Fl. Exs. Aust.-Hung.* 1273 (B, H, L, MIN, US, W).

BELGIUM. Warche valley near Beverce, *J. H. Kern & T. J. Reichgett* 16629 (KYO).

CZECHOSLOVAKIA. Bohemia, Vernerice, Bobri valley, *B. Deylova* in 1971 (H, KYO, NCU, UC); Gervont, Tatra, *A. Grzegorzak* in 1884 (L); Trencin, *J. Holuby* in 1875 (WA); Bohemia, Gratzen in Thiresienthale, *J. Jahn* in 1888 (KSC); Bohemia, Gratzen, *J. Jahn* in 1888 (W); Bohemia, Marianske e Lazne, Königswart, *J. Jahn* in 1906 (W); Bohemia, E Moravia, opposite Vsetin, *G. Rican* 1148 (CAS, DAO, DS, H, MO, MT, UC, W, WA); Bohemia, Sv. Marketa, *J. Trakal* in 1947 (H, W); Bohemia, Teplice, *M. Winkler* in 1853 (W).

DENMARK. Hellebaek, *M. Engstedt* in 1910 (H); Kappel, Buchenwalder, *E. Fuchs* in 1883 (RO); Hvalso, *J. Jefyresen* in 1889 (TUR); Bornholm Island, *T. Jensen* in 1866 (DS); Silkeborg, Vesterskov, *M. Lorenzen* in 1893 (W); Jylland, Horsens, Silkeborg, Sönderskov, *J. Suominen* in 1965 (H); Skov uid Skarid Sd., *Warming* in 1896 (WS); Haslum Forest near Randers, *K. Wündstedt* D13A (KYO); Kolding, Jylland, *K. Wündstedt* D25 (KYO).

FRANCE. Near Sarrebourg, *Baudot* in 1868 (POM), *Baudot* in 1838 (RO); Haute Savoie, Mt. Saxonnex, *E. Bourgeau s.n.* (CAS); Haute Savoie, Brison, *E. Bourgeau* in 1868 (DS); Haute Savoie, *E. Bourgeau* in 1869 (B); Colmars, *Boutignay* in 1848 (DS); Isere, La Riviere, near la cascade du Versoud, *J. Cortey* 2723 (MT); Haute Savoie, St. Nicolas la Chapelle, *Delavan* in 1863 (DS); Yonne, Avallon, *G. Desplantes* in 1928 (DS), *G. Desplantes* 2383 (B, MT); Alsace, Strasbourg Botanical Garden, *J. Gardner* 1330 (MT); Gavarnie, *Gavelle* in 1963 (DAO); Nièvre Dept., Mt. Sanche, *Gillot* in 1883 (MT); Cantal Dept., forests of Claux, *E. Jordan* 1684 (L); Cantal Dept., forests of Lioran, *E. Jordan* 2146 (DS); Morvan, Caelie valley, *S. Lassimonne* 693 (US); Pringy, *Luget* in 1867 (MO); Berhe, Laprugne, *M. Migout* in 1875 (MT); Isere, Grande-Chartreuse, *A. Pellat* in 1889 (MIN); Isere, Uriage & St. Pierre-de-Chartreuse, *A. Pellat* 4886 (DS, MT); Savoie, Vallarasson near Queige, *E. Perrier* in 1865 (MO, UC); Vasages Dept., Chiefosse, *L. Perrin* in 1874 (DS); Cantal Dept., forests of Claux, *J. de Puyfol* 1684 (MA, MT, W); Mt. Dore, forests of Capucin, *St.-Lager* in 1885 (DAO); Mosalle, Bitche, *F. Schultz s.n.* (UC); Wissembourg, Lauter valley, *F. Schultz* 476 (DS, H, W); Haute Savoie, Benneville, Mt. Brizon, *J. Timothee* in 1865 (L); Champagney, *X. Vendechy* in 1867 (DS); Champagney, Bahin valley, *C. Venosely* in 1867 (DAO); Lavoie, Tulle, *Wilezek* in 1921 (OKL).

GERMANY, EAST. Sachsen, Dresden, *Aitzss?* in 1883 (CAS); Sachsen, Dresden, *H. Beger* in 1922 (B); Thuringen, Sobenstein, *H. Beger* in 1922 (B); Thuringen, Ob. Saaltal, *J. Bornmüller* in 1922 (B); Rügen, *Bothe Herb.* in 1903 (B); Bornholm, Storefos, *Buchheim* in 1957 (B); Ilsenburg, *L. & J. Buse* in 1849 (L); Thuringen, Fröhl Wieder Kunft, *C. Haussknecht* in 1892 (SMU); Erzgebirge, *E. Korb* in 1919 (W); Allgau, Freiberg, *Kuhn* in 1870 (NEB); Brandenburg, near Vernnitz, *O. Ladermann* in 1925 (DAO); Brandenburg, Tribbel, Laüka by Steinmetz, *O. Lasbunam* in 1925 (IDS); Brandenburg, Hernsdorf, near Glunicke, *C. Mueller & W. Retzdorff* in 1878 (COLO, MIN, MTMG); Dresden, *Reichenbach s.n.* (NA, PH); Sachsen, *A. Schade* in 1907 (MIN); Brandenburg, Berlin, *R. Schulz* in 1902 (B); Neumark, Königsberg, *R. Schulz* in 1910 (B); Karl Marx Stadt (Chemnitz), *M. Weiker* 492 (POM); Thuringen, near Leutenberg, *A. Werner* in 1895 (MIN).

GERMANY, WEST. Bergisches Land, road to Herrenstrunden, Bergisch-Gladbach, *H. Andres* 89 (WS); Schleswig-Holstein, N of Lütjenburg, *E. Boel et al.* 262 (COLO, H); Holstein, near Malente, *F. Buchenau* in 1896 (CAS); Zwalbach, *M. Dewes* in 1904 (B); Elberfeld, *F. Eggev* in 1891 (WA); Upper Bavaria, near Oberaudorf, vicinity of Trisslbades, *G. Eigner & Dr. Vollmann* 625 (UC, WA); Schleswig, Kappeln, *E. Fuchs* in 1883 (COLO); Oberhessen, Kr. Lauterbach, road to Hochwaldhausen, *H. Hupke* in 1967 (COLO, MONTU); Kr. Lauterbach, Ilbeshausen, *H. Hupke* in 1969 (H, MAK), *H. Hupke* in 1971 (H, TUR); Bavaria, near Bamberg, *Lanz* in 1909 (DAO, MT); W. Hartz Mts.,

Achtermannstal, S of Oker, A. *Leeuwenberg* 1637 (SMU); Meinberg, A. *Prager s.n.* (CAS); Bavaria, near Wissemburg, F. *Schultz in 1859* (DAO, MT).

ITALY. Corno, San Primo Mt., U. & C. *Cedercreutz in 1957* (H); near Monterosso, *Dnty in 1875* (RO); Pescara, Abruzzo, A. *Kuntze in 1866* (H); near Verzuolo, E. *Paoletti in 1899* (GH); Cottian Alps, E. *Rostan in 1880* (L).

NORWAY. Vestfold, Sande hd., Berger, J. *Dyring in 1917* (COLO, SASK); Hordaland, Standebarm, T. *Lillefosse in 1940* (H).

POLAND. Bialostok ("Bialzstolkin"), A. *Cunnüchan in 1891* (L); Myslenice Dist., Lipnik, J. *Dobrazanska & A. Szymoniakowna, Pl. Pol. Exs. 350* (DS, KYO, L, MO, MT, US, WA); Lubon Wielke, A. *Donle in 1966* (KRA); Bukowa Gora, Kielce, Klonow, K. *Kaznowski in 1924* (POM); Swietokryzski Mts., R. *Kobewice in 1924* (WA); Szrecino, Cieszyn, W. *Wojewoola in 1955* (KRA); Krackow, without collector in 1852 (B).

SWEDEN. Västergötland, Hummeberg, Nygard, E. *Almquist in 1912* (ARIZ, CAS, DAO, MT); Bohuslan, Ödsmåls, E. *Almquist in 1946* (MT, W); Skåne, Degeberga, Forsakar, E. *Asplund in 1928* (MT); Skåne, Helsingborg, G. *Bågenholm in 1894* (MIN); Småland, Jönköping, H. *Carlson in 1889* (MO); Skåne, E. *Fries in 1857* (MO); Helsingborg, R. *Fristedt in 1866* (US); Skåne, Palskop at Helsingborg, *Gyllenstjerna s.n.* (W); Huskvarna, C. *Johansson in 1876* (H, TUR, W); Halland, K. *Larson in 1894* (MTJB); Sverge, Skåne, Båstad, A. L. *Legerström in 1913* (TEX); Skåne, Hallandås, Simontorp, B. *Lidforss in 1885* (MT); Smål, Huskvarna, J. *Lundequist in 1895* (MT), J. *Lundequist in 1897* (B); Stockholm, Västahamnen, F. *Nilsson in 1926* (UC); Bohuslan, Foss Parish, Saltkällan, F. *Nordstrom in 1900* (SMU); Helsingborg, Pålshö, H. H. *Ringius 521* (H, PH, TUR); Skåne, Pålshö, E. *Skotte s.n.* (WTU); Västergötland, Kinnekulle, A. *Stalin in 1913* (DAO); Stockholm, C. *Thedenius in 1891* (NA); Skåne, Pålshö near Helsingborg, *Wallengren in 1883* (MIN).

SWITZERLAND. Crana-Vergeletto, Onsernone Valley, J. *Bår in 1906* (Z); Vaud, Mts. of Bex, *Boissier Herb. 1898* (UC); Valais, Troistorrents, S. *Curchod & P. Hainard 7653* (C, H, RNG); Meyringen, C. *Fischer-Boster in 1873* (Z); above Bex, C. *Meissner in 1819* (US); Bern, Reichenbach near Meiringen, C. *Meissner in 1829* (US); Neuchatel, Bois Rond, D. *Mouthier s.n.* (MT); Valais, Vernayaz & Salvan, J. G. S. *s.n.* (Z); Brisen, E. *Schmid in 1916* (Z); Jura, Belchen district at Eptingen, C. *Simon in 1965* (CAS); Toggeliloch near Düdingen, T. *Taquet in 1922* (MT); Graubünden, Seewis, K. *Urmi-König in 1976* (MO); Schaffhausen, Schleithem, *Vetter s.n.* (Z); Zurich, between Übrerrüth & Oberegg, W. *Wernol in 1906* (MO).

UNITED KINGDOM: ENGLAND. Westmorland, Rydal, J. *Ball in 1838* (IA, MO); Westmorland, Windermere, J. *Ball in 1876* (US); Staffs, Oakamoor, Star Wood, E. *Edees 8812* (DAO); Warwickshire, SW Birmingham, Harborne, C. M. *Goodman in 1960* (NO); Westmorland, Rydal, G. E. *Martindale 607b* (MIN); Westmorland, Ullswater, Glencoyne Wood, P. H. *Raven 16223* (DS); Lancashire, E of Lake Coniston, A. *Wilmot in 1937* (DAO). IRELAND. Leitrim, Glenade cliffs, W. *Barton in 1913* (DAO); banks of Lough Erne, J. *Ball in 1837* (PH); Belfast, J. *Ball in 1837* (GH, MTMG). SCOTLAND. W side of Loch Lomond, J. *Ball in 1850* (US); Arran Co., Brodick, I. W. *Brown in 1857* (H); Midlothian, Edinburgh, Braid Hermitage, A. *Craig-Christie in 1881* (SHIN); Colinton, Edinburgh, A. *Craig-Christie in 1898* (SHIN); Perthshire, Glen Lochay, A. *Currie & H. Munro 787* (DAO); Midlothian, Edinburgh, Colinton Dell, B. P. *Donaldson 50* (NCU); Arran, G. *Forrest, Jr. in 1928* (W); Perth, banks of Loch Tay, W. *Gardiner in 1862* (W); Arran Island, Brodick, A. E. *Lomax in 1885* (DS); Perthshire, near Loch Tay, A. E. *Lomax in 1887* (MIN); Inverness, Arisaig, M. *McCallum-Webster 5572* (DS); Inverness, Glen Beasdale, M. *McCallum-Webster 5577* (DS); Perthshire, Glen Lyon, M. *McCallum-Webster 5676* (DAO, DS); Perthshire, Lower, shores of Loch Tay, M. *McCallum-Webster 5677* (DAO, DS); Sutherland, Inchnadamph, M. *McCallum-Webster 5755* (RSA); Inverness, Kirkhill, M. *McCallum-Webster 5794* (DAO, DS); Brackla, edge of Loch Ness, M. *McCallum-Webster 8442* (MO); Inverness, just N of Tomich, M. *McCallum-Webster 18404* (MO); Inverness, Cannich Strathglass, M. *McCallum-Webster 18408* (MO); Lewiston, by Loch Ness, M. *McCallum-Webster 18419* (MO); Drumnadrochit, Dirach, M. *McCallum-Webster 18552, 18553, 18554* (MO); edge of Loch Ness, Aldowine, M. *McCallum-Webster 18581* (MO); Inverness, by R. Enrick, 1 mi. W of Drumnadrochit, C. *Townsend in 1947* (SMU). WALES. Merioneth, 0.25 mi. N of Llany-mawddwy, P. H. *Raven & W. Condry 16297* (RSA); Merioneth, Llanbedr, P. H. *Raven & P. Benoit 16302* (DS); Merioneth, Dolgellau, P. H. *Raven & P. Benoit 16314* (DS); Carmarthenshire, Rhydygrocs, Cilycum, I. *Vaughn in 1953* (MT).

#### U.S.S.R.

GEORGIAN S.S.R. Osetiya, between Tkue & Koshehka, A. & V. *Brotherus 342* (H, *C. alpina* subsp. *alpina* and *C. lutetiana* subsp. *lutetiana* on same sheet). LATVIAN S.S.R. Perse R. valley,

Kokenhusen, *Bruttan* 273 (MW); Friederichstadt, Windsheim, foot of Dina R. cliff, *P. Lackschewitz* 7601 (MW). RUSSIAN S.F.S.R. Ural Mts., Sverdlovsk ("Katherinaburg"), *Clere* in 1875 (GH); Sachalin, Yuznosakhalinsk ("Toyohara"), *T. Sawada* in 1923 (TI); Kaluga Prov., Juchnev Dist., *A. K. Skvortsov* in 1972 (MO); Sachalin, vicinity of Yuzhno-Sachalinsk, *V. N. Voroshilov* 7348 (MHA). UKRAINIAN S.S.R. Zarkapatsk Prov., Tyachevskiy, Polaninski Mt., *K. N. Igoshina* in 1949 (MW). (See also: Skvortsov, 1979, for further discussion and distribution of *C. × intermedia* in the Soviet Union.)

#### ASIA

JAPAN. HOKKAIDO: Rishiri Island, *U. Faurie* 3533 (KYO, SAP).

*Circaea × intermedia* is a sterile hybrid between *C. alpina* subsp. *alpina* and all subspecies of *C. lutetiana* and is intermediate between the two parents in many ways. Vegetatively *C. × intermedia* generally resembles *C. alpina* subsp. *alpina* more closely but in size and morphology of floral parts it is often more similar to *C. lutetiana*. The numerous synonyms are evidence of the confusion that *C. × intermedia* has caused in the past. Raven (1963) has clarified the situation in the British Isles and has pointed out that the most useful character for separating *C. alpina* subsp. *alpina*, *C. lutetiana* and *C. × intermedia* is the nature of the inflorescence. In *C. alpina* subsp. *alpina* the flowers are held in terminal corymbiform clusters on erect or ascending pedicels at the tip of the raceme. The flowers open before the axis of the raceme elongates. In *C. lutetiana* the axis of the raceme elongates before the flowers open. The flowers are held on pedicels that are distantly spaced and held perpendicular to the axis of the raceme. The flowers of *C. × intermedia* open as the raceme elongates and are held on ascending to spreading pedicels that are intermediate in spacing between the two parents. A low nectar-secreting disc is present in *C. × intermedia* but is less conspicuous than in *C. lutetiana*. An exserted nectary is absent in *C. alpina*. A bracteole is present at the base of the pedicel in *C. × intermedia*, *C. alpina* subsp. *alpina* and *C. lutetiana* subsp. *canadensis*. Bracteoles are very rarely present in *C. lutetiana* subsp. *lutetiana* and *quadrisulcata*.

*Circaea × intermedia* is vegetatively more vigorous than either *C. alpina* or *C. lutetiana* and often forms large, dense colonies. It is highly probable that *C. × intermedia* has been able to increase its range, at least over short distances, by the breaking off and transportation of rhizomes either naturally through the action of water or through the activities of man. The latter may be at least partially responsible for plants appearing spontaneously in gardens and other cultivated areas where the rhizomes could be brought in with soil. Raven (1963) has also suggested that the presence of the hybrid in areas where either one or both of the parents is absent could be due to changes in climate since the last glaciation which have caused some habitats to become unsuitable for one or both parents, but still suitable for the hybrids. The ability of hybrids of *Circaea* to persist for many years can be inferred from situations in North America and Japan where hybrids can still be found growing in the same places where they were collected 50 to 100 years ago, even though they are nearly or completely sterile. That these plants are not the result of recent hybridization cannot be ascertained, but the absence of one or both parents where the hybrids occur tends to partially rule out that possibility.

Benoit (1966, 1975) has synthesized *Circaea × intermedia* artificially using *C. alpina* subsp. *alpina* as the pistillate parent. Attempts to produce the hybrid using

*C. lutetiana* as the pistillate parent have been unsuccessful. Benoit states that the artificially produced hybrids are more similar to *C. alpina* subsp. *alpina* morphologically but probably resemble closely some natural populations of *C. × intermedia*. Backcrossing to *C. lutetiana* results in plants that produce fruits (Benoit, 1975) but it is not known if these are fertile.

Despite the fact that three different subspecies of *Circaea lutetiana* are involved in the formation of *C. × intermedia*, it is usually impossible to say with certainty which subspecies is involved based on morphological characters. Plants of *C. × intermedia* from Europe occasionally have pubescent stems (as do plants of *C. lutetiana* subsp. *lutetiana*) but the plants from Asia and North America and the vast majority from Europe have glabrous stems. Petal shape is variable in *C. × intermedia* with some plants having petals that are slender and cuneate at the base as in *C. alpina* subsp. *alpina* while others have petals that are broadened and with rounded bases as in *C. lutetiana*.

Haber (1977) and Cooperrider (1962) have provided statistical evidence for the intermediacy of *C. × intermedia* between *C. alpina* subsp. *alpina* and *C. lutetiana* subsp. *canadensis* in Ontario and Ohio in North America. Based on chromatographic evidence, Weimarck (1973) has suggested the possibility of backcrossing and introgression in the three taxa in Sweden.

*Circaea alpina* L. subsp. *imaicola* (Asch. & Magnus) Kitamura × *Circaea repens* Wallich ex Asch. & Magnus.

Morphologically intermediate between *Circaea alpina* subsp. *imaicola* and *C. repens*. Erect, 2–7 dm tall, simple below the inflorescence. Plants densely pubescent; the stem with soft, short, falcately recurved hairs, ca. 0.2 mm long; the inflorescence with soft, short, capitate and clavate tipped, glandular hairs, 0.2–0.3 mm long, often with falcate hairs as on the stem intermixed, at least below; the petioles with hairs as on the stem but these upwardly curved; the leaves glabrescent to evenly and densely pubescent with short falcate hairs, ca. 0.1 mm long. Stem green. Leaves horizontally spreading, green, opaque to slightly translucent; those just above the middle of the stem the largest, 5–7 cm long, 2.5–4.8 cm wide; becoming gradually to abruptly reduced in size upward to the base of the inflorescence and eventually bractlike and alternate, gradually to abruptly reduced in size downward; ovate to broadly so, acute to short acuminate at the apex, rounded to subcordate at the base, denticulate to dentate, glabrescent to densely pubescent on both surfaces, the margins with short, falcate cilia, ca. 0.1 mm long. Petioles 1–4 cm long, pubescent, sometimes densely so, with soft, upwardly curved falcate hairs, 0.1–0.2 mm long. Inflorescence densely pubescent with short, capitate and clavate-tipped, glandular hairs, 0.2–0.3 mm long, these intermixed with and giving way below to short, falcately recurved hairs; terminal on the main stem and at the tips of short, lateral branches arising from near the base of the terminal inflorescence, simple or abundantly branched with numerous lateral racemes, the lateral branches subtended by reduced leaves or leaflike bracts. The terminal raceme, from the uppermost reduced leaf or leaflike bract, 0.8–1.5 cm long at initiation of flowering, to 14 cm long at cessation of flowering; the lateral racemes 0.5–3 cm long at initiation of flowering, to 8.5 cm long at cessation of flowering, subequal in length on the same plant. Flowering pedicels

1.5–3.8 mm long, ascending at approximately 45° angles to the axis of the raceme, pubescent, with a few, short, capitate and clavate-tipped glandular hairs, 0.1–0.2 mm long; with a setaceous bracteole, to ca. 0.3 mm long at the base; rather closely spaced, the flowers clustered near the apex of the raceme. Fruiting pedicels developing to ca. 4.8 mm long before abortion of the fruits. Buds glabrous or glabrescent with a few minute glandular hairs; oblong elliptic to broadly oblong in outline, rounded to the obtuse or minutely mammiform apex; from the summit of the ovary, 1.3–2.7 mm long, 0.8–1.5 mm thick just prior to anthesis. Ovary 1.2–1.4 mm long, 0.6–0.7 mm thick at anthesis, clavate to obovoid, sparsely to densely covered with soft, translucent, uncinata hairs. Floral tube 0.3–0.5 mm long, 0.15–2 mm thick, funnelform to broadly so. Sepals 1.4–2.3 mm long, 1–1.5 mm wide, glabrous, purple or pink (or white?), ovate to oblong ovate, rounded to the obtuse or minutely mammiform apex, spreading to slightly reflexed in flower. Petals 1.2–1.5 mm long, 1.7–2 mm wide, most commonly wider than long, pink (or white?), obdeltoid to broadly so to transversely broadly oblong in outline; the apical notch 0.6–0.7 mm deep,  $\frac{1}{2}$ – $\frac{3}{4}$  the length of the petal, the petal lobes narrowly to broadly rounded. Stamens spreading or ascending at anthesis, equaling or shorter than the style; filaments 1.2–1.7 mm long; anthers 0.3–0.4 mm long, 0.3–0.4 mm thick. Style erect, straight, 1.9–2.2 mm long, topped by an obconic to transversely oblong, bilobed stigma, 0.2–0.3 mm tall, ca. 0.3 mm thick. Nectary wholly within the floral tube. Mature fruit apparently not developing, the ovary enlarging to 1.8 mm long, 0.7 mm thick, before aborting, sparsely to densely covered with stiff, translucent, uncinata hairs ca. 0.3 mm long. Young fruiting pedicels horizontally spreading. Combined length of pedicel and most mature fruit, ca. 7 mm long.

Distribution: Known only from southwestern China. Between 1,800 and 3,200 m. Flowers, August to early October.

Representative specimens examined:

CHINA: SICHUAN: Pao-hsing Hsien, *K. Chu* 3481 (BM, E). YUNNAN: Fen-shui-ling, *E. Maire* 341/1913 (E); Ta-hai, *E. Maire* 997 (BM, E); Ta-hai, *E. Maire in* 1912 (G).

The plants that are here considered to be hybrids between *Circaea alpina* subsp. *imaicola* and *C. repens* are intermediate between those two species in several ways and have highly sterile pollen. In stature, they resemble *C. repens* most closely, but have the inflorescence more abundantly branched than in either of the parental species. The flowers in the hybrids are smaller than in *C. repens*, rather closely spaced and held on ascending, minutely glandular pubescent pedicels. In *C. alpina* subsp. *imaicola* the pedicels are erect to ascending and glabrous. In *C. repens* the pedicels are glandular pubescent and most commonly spreading at right angles to the raceme axis. The hybrid also has petals that are deeply notched as in *C. repens* but are often broader as in some plants of *C. alpina* subsp. *imaicola*.

Pollen fertility in *Circaea alpina* subsp. *imaicola* × *C. repens* averaged 13% in 674 grains examined with all normal, 3-pored grains.

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